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INDIA WEATHER REVIEW, 1955

ANNUAL SUMMARY

PART C

STORMS AND DEPRESSIONS

DEPRESSIONS AND CYCLONIC STORMS

During the year, 6 cyclonic storms and 7 depressions formed in the Bay of Bengal. No depression or storm formed in the Arabian Sea. The dates of activity of the storms and the greatest barometric depths observed (or estimated) near their centres are summarised in the following table.

TABLE 1

Locality	Month	Date	Greatest observed barometric depths
Bay of Bengal	May	3rd-7th	11 mbs. (estimated).
Do.	August	31st Aug.-7th September.	11 mbs.
Do.	September	28th Sept.-5th October.	16 mbs. (estimated).
Do.	October	4th-14th	30 mbs.
Do.	November	2nd-9th	20-25 mbs. (estimated)
Do.	November	28th Nov.-2nd December.	60 mbs. (estimated).

The detailed descriptions of these storms and depressions are, as usual, followed by a list of western disturbances of the year, of the more important local storms and of the localities in which winds of force 9 B.F. or more unconnected with cyclonic storms were experienced by ships in the Indian Seas.

1. Cyclonic storm in the Bay of Bengal—3rd to 7th May 1955.—On the morning of 1st May a feeble upper air cyclonic circulation was noticeable over the southwest Bay of Bengal between 5,000 and 10,000 ft. a.s.l. On the next morning, a shallow trough of low pressure appeared on the sea level chart over the area and there was widespread thunderstorm activity in Tamilnad and along the north Circars coast. The trough gradually intensified and by the 4th evening, conditions became markedly unsettled over the southwest Bay of Bengal. At 1730 hrs. IST on the 4th, S.S. Malika (Lat. 13.9° N and Long. 84.9° E) reported easterly winds, 10 knots and

overcast skies, while S. S. Rajula (Lat. 9.8° N and Long. 84.5° E) reported northwesterly winds, 15 knots and continuous rain. By the 5th morning, a depression had formed with its centre at 0830 hrs. IST of that day near Lat. 12.0° N and Long. 83.5° E. The following observations of the 5th are relevant in this connection.

TABLE 2

Name of ship/ Station	Position		Hr. of obsn. IST	Wind		Weather re- marks.
	Lat. °N	Long. °E		Direction	Speed (kts.)	
S.S. Clan Maclean.	11.5	85.1	0530	SSW	9	Continuous drizzle.
S.S. Malika.	14.9	85.4	0530	E	15	Slight continuous rain.
Madras	.	.	0530	NNE	2	
Madras	.	.	0830	ENE	16	Thunderstorm.

The fall of barometric pressure along the south Circars and north Coromandel coasts since the previous evening (corrected for diurnal variation) was 2 to 3 mbs. The estimated pressure deficiency at the centre of the depression was about 6 mbs. The depression moved north-northwestwards, intensifying at the same time. By the morning of 6th, it became deep and was centred at 0830 hrs. IST near Lat. 14.0° N and Long. 83.0° E. The following observations of the 6th are significant in this connection.

TABLE 3

Name of ship/ Station	Position		Hr. of Obsn. IST.	Wind		Weather re- marks.
	Lat. °N	Long. °E		Direction	Speed (kts.)	
S.S. Liverpool	14.1	83.5	0530	SSE	26	Rain showers
Masulipatam	.	.	0530	ENE	16	
			0830	NNE	18	Drizzle.
Kakinada	.	.	0830	NE	16	Continuous moderate rain.

The pressure fall along the north Coromandel and south Circars coasts had become prominent and the pressure deficiency at the centre of the deep depression was estimated to be about 8 mbs. The deep depression intensified further during the course of the day into a cyclonic storm of small extent and lay at 1730 hrs. IST with its centre near Lat. 15.0° N and Long. 83.0° E. Its intensification into a storm was evidenced by a considerable strengthening of upper winds at Masulipatam in the afternoon of that day, the winds at 2,000 ft. a.s.l. being 56 knots from eastnortheast. The storm moved north-northwestwards and was centred at 0130 hrs. IST of the 7th, about 70 miles to the southsoutheast of Kakinada which reported at that hour northeasterly wind of 25-30 knots. It lay close to coast near Lat. 16.5° N at 0830 hrs. IST of 7th. The estimated pressure deficiency at the centre of the storm was now about 11 mbs. Widespread and locally heavy rain was reported from coastal Andhra Pradesh, particularly the Visakhapatnam district. The storm weakened into a deep depression and crossed the coast to the south of Kakinada on the forenoon of 7th. The lowest pressure recorded at Kakinada was 998 mbs, about 8 mbs. below normal. It further weakened rapidly into a low pressure area by the evening and filled up the next day.

The maximum wind speed (surface) reported at Kakinada in association with the storm was 30 knots from the northeast at 2330 hrs. IST on the 6th Visakhapatnam recorded a maximum surface wind of 47 mph on the anemograph at 0415 hrs. IST on the 7th. Shri N. S. Bhaskara Rao, an officer of this department who went subsequently on tour to study the damage caused by the storm has made the following observations in his report "...judged by the damage caused to trees, it is possible that a number of localities in east Godavari district might have experienced winds of maximum force B.F. 7 to 8".

Widespread and locally heavy rain with some very heavy falls, occurred in north coastal Andhra Pradesh on the 7th and 8th, particularly in Visakhapatnam district. According to newspaper reports, breaches occurred in the Southern Railway's track about 40 miles south of Waltair on the 7th morning, dislocating the normal rail traffic. Collapse of thatched houses, bursting of minor irrigation tanks and loss of cattle and crops were reported in Tuni taluk in east Godavari district and the taluks of Yellamanchilli, Narasapatnam and Anakapalli in Visakhapatnam district. The following table gives the district averages and the significant amounts of rainfall associated with the cyclonic storm.

TABLE 4

District	District Averages on						Particularly heavy falls
	3	4	5	6	7	8	
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.							
Visakhapatnam	1.2	4.7	2.2	On 7th-Polavaram 9.5", Anakapalli 6.1", Balacheruvu 6.3", Visakhapatnam 5.7", Bhimilipatam 9.1", Konada 6.3".			
On 8th-Srungavarapukota 6.3", Bhimilipatam 5.4".							

2. Deep depression in the Bay of Bengal—13th to 19th May 1955.—On the 13th May, a low pressure wave from the east was noticed to be moving into the south Andaman Sea. The wave moved westnorthwestwards during the course of the next two days and conditions became unsettled in the south Bay on the morning of the 16th. S. S. Nurani (Lat. 10.4° N, Long 87.6° E) reported eastsoutheast 5 knots and S. S. Safinaerab (Lat 18.3° N, Long. 89.6° E) northeast 10 knots at 0530 hrs. IST of 16th while Trincomalee reported northwest 12 knots, continuous slight rain at 0830 hrs. IST of that day. The unsettled conditions became more marked at 1130 hrs. IST, when S. S. Havildar (Lat. 9.8° N, Long. 83.2° E) reported westnorthwest 14 knots and continuous heavy rain, S. S. Nurani (Lat. 9.7° N, Long. 86.7° E) southeast 15 knots, S. S. Singula (Lat. 5.6° N, Long. 87.2° E) west-southwest 13 knots and S. S. Subader (Lat. 5.9° N, Long 86.0° E) west 11 knots and intermittent moderate rain. By the evening, pressure departures over Ceylon became about 3 mbs. but the departures over Coromandel coast were still positive. The winds over Coromandel coast and Ceylon backed from north/northeast to northwest/north and became stronger. Fairly widespread rain was reported from Ceylon and Coromandel coast. By 1730 hrs. IST of 16th, a depression formed over the south Bay centred near Lat. 10.0° N, Long. 85.0° E. The depression moved northwestwards and was centred near Lat. 10.5° N, Long. 84.0° E at 0130 hrs. IST of 17th. By this time, an increase in the precipitation together with a marked fall of pressure was observed over the Coromandel coast, while a decrease in precipitation accompanied by a rise in pressure was observed over south Ceylon. The depression continued its northwesterly course and deepened by 0830 hrs. IST of 17th when it was centred near Lat. 11.0° N, Long. 83.0° E, as indicated by the following observations.

TABLE 5

Date	Name of station/ ship.	Position.		Hr. of Obsn. I.S.T.	Wind Direc- tion.	Speed (kts)	Weather remarks
		Lat. °N	Long °E				
17-5-55	S.S.Havildar.	12.7	84.1	0830	ESE	14	Moderate to heavy rain at the time of observation. (Thunderstorm during the preceding hour).
17-5-55	S.S. Nurani	08.3	84.5	0530	WSW	28	
Do.	S.S. Jagrani	09.5	81.4	0530	NW	11	Continuous slight rain.
Do.	Trincomalee			0830	W	10	
Do.	Madras			0830	NNW	18	Intermittent slight drizzle.
Do.	Nagapatam			0830	NW	7	Continuous slight rain.

At this stage, the pressure departure at the centre of the depression was estimated to be about—12 mbs. The upper winds strengthened considerably in the field of the depression and a well marked front directed towards the northwest from its centre was observable. The deep depression then moved westnorthwestwards and was

centred at 1730 hrs. IST of 17th near Lat. $11^{\circ}5'N$ Long. $81^{\circ}5'E$. The following observations are relevant in this connection.

TABLE 6

Date.	Name of station/ Ship	Position		Hr. of Obsn.	Wind.		Weather remarks
		Lat. °N	Long °E		Dirrec- tion.	speed (kts.)	
17-5-55	S.S. Clanlamount	12.0	82.1	1730	ESE	8	
Do.	S. S. State of Madras.	10.3	81.4	1730	W	13	Squalls dur- ing the past hour,
Do.	S.S. Havildar.	14.0	84.5	1730	ESE	17	
Do.	Madras			1730	NE	20	Intermittent slight driz- zle.
Do.	Cuddalore			1730	NNE	7	Continuous slight rain.
Do.	Negapatam			1730	W	11	Intermittent slight driz- zle.

Continuing to move in a westnorthwesterly direction, the deep depression weakened during the night and crossed the Coromandel coast near Lat. $12.0^{\circ}N$ between Cuddalore and Madras by 0830 hrs. IST of 18th, when Madras reported east 18 knots and slight rain-shower, while Cuddalore reported southwest 9 knots and thunderstorm with rain. The pressure departures at Madras and Cuddalore at this hour were—7 mbs. and 9 mbs. respectively. Widespread and locally heavy to very heavy rain was reported from Coromandel coast and the adjoining inland districts. After crossing the coast, the depression weakened into a low pressure area which lay over west Mysore and adjoining parts of Malabar-South Kanara on the morning of the 19th. Thereafter, the low pressure area moved northeastwards and became unimportant over the west central Bay by the evening of 21st.

Under the influence of the depression, fairly widespread and locally heavy rain was reported from northern portions of coastal Tamilnad on the 17th and 18th. The depression was also responsible for a temporary advance of the southwest monsoon into the Comorin Maldives area on the 18th and into Travancore-Cochin and Malabar-South Kanara on the 19th. Widespread and locally very heavy rain occurred over these areas on the 18th and 19th and in south Konkan on the 20th. Some noteworthy amounts of rainfall are:—Cuddalore 13" during the 48 hrs. ending at 0830 hrs. IST of 18th, Fort Cochin and Kozhikode, 6" each on the 19th, Honavar 9" and Karwar 6" on the 20th.

The following table gives the district averages and significant amounts of rainfall associated with the deep depression.

TABLE 7

District.	District Averages on							Particularly heavy falls
	16	17	18	19	20	21	22	
Malabar	1.0	4.9	3.8	3.0				18th-Cochin 5.1", Iritty 9.5", 19th-Irkikkur 7.5", Payyannoor 6.4", Taliparamba 7.2", Tellicherry 7.8", Kuttiyadi 9.6", Quilandy 5.7", Kozhikode 6.1", Chowghat 7.5", Triprayar 7.2", Cochin 6.1", Lakkidi 5.9".

TABLE 7—contd.

District	District Averages on							Particularly heavy falls
	16	17	18	19	20	21	22	
								20th-Vayithiri 6.7", Payyannoor 8.6", Taliparamba 11.3", Kuttiyadi 5.2", Lakkidi 10.9", Thagarapadi 8.3".
								21st-Lakkidi 7.2", Thagarapadi 5.7".
South Kanara.	1.4	2.4	6.0	3.9				19th-Hosdurg 7.3", Mulki 5.0", 20th-Kasargod 5.7", Puttur 7.2", Karkal 5.4", Udipi 9.8", Coondapoor 10.7", Beltangady 8.1", Baindur 11.0".
								21st-Karkal 5.9", Co- ondapoor 6.4", Beltangady 7.3", Baindur 13.6".
Salem			2.2	1.1				19th Dharampuri 5.2".
Coimbatore		1.0						
Nilgiris		1.5	4.6	3.0	1.8			18th Devala 5.0", Na- duvattam 14.9", Ootacamund 7.6", Hul- hatty 13.7".
								19th-Gudalur 8.2", Naduvattam 6.5", Glenmorgan 6.0".
								20th-Gudalur 5.3", Naduvattam 5.4".
Coorg	1.0		1.8	4.6	2.1			20th-Virajpet 5.7", Napoklu 5.2", Bhagmandala 10.8", Karika 9.3", Pulin- gotti 9.3", Makut 9.6", Sampaji 5.3".
								21st-Makut 5.1".
Mysore			1.6					19th-Bandipur 5.2".
Mandya			1.0					
Chikmagalur			1.5					19th-Narasimharaja- pura 5.4", Bal- honnur 5.1".
Kottayam		1.4	3.4	2.3	2.5	1.3		18th-Peermade (Resi- dency) 8.5".
								19th-Malayattur 5.0", Parur 5.4", Karikode 5.6", Vaikom 5.0", Peermade (Resi- dency) 7.0".
								20th-Peermade (Resi- dency) 5.0", Periyar 5.5".
								21st-Munnai 6.9", Devi- kulam 5.3", Periyar 7.1".
Quilon	1.1	1.4	2.6	2.5				20th-Haripad 5.7", Pattanamthitta 5.2".

TABLE 7—*contd.*

District	District Averages on						Particularly heavy falls
	16	17	18	19	20	21 22	
Trivandrum					1.7		18th-Ponmudi 5.1",
Cochin .	1.3	1.8	5.1	1.7	2.2		18th-Cochin Port 5.1". 19th-Cochin (Obsy) 5.3", Cranganore 5.9", Mukundapuram 6.0", Trichur 6.9", Cochin Port 6.1".
Madras .	3.5	1.4					
Chingleput .	2.6	1.9					
North Arcot .	1.9	1.5					17th-Tiruvannamalai 8.2",
South Arcot .	2.2	3.9					18th-Panruti 8.4", Cuddalore 9.5", Vriddachalam 7.7", Kottumylor 7.1", Pellandurai Anicut 5.1", Vanamadevi, Anicut 6.4", Tiru Koyilur Anicut 6.9".
Tanjore .	1.5	1.1					17th-Neidavasal 5.8". 18th-Neidavasal 6.9".
Tiruchirapalli.	1.1	1.4					
Madurai .							18th-Kodaikanal 5.2".

3. Depression in the Bay of Bengal—22nd to 25th June 1955.—On the morning of 22nd June, the monsoon trough extended into the northwest Bay of Bengal and adjoining west central Bay under the influence of an easterly wave. A marked strengthening of the monsoon was also noticeable over the Bay to the south of Lat. 15°N. Widespread and locally heavy rain was reported from Tenasserim, Deltaic Burma and the Bay Islands. In the course of the next day, an upper air cyclonic circulation extending upto 10,000 ft. a.s.l. developed over the northwest and adjoining west central Bay and conditions became unsettled in that area. The unsettled conditions developed into a shallow depression on the morning of 24th, with its centre at 0830 hrs. IST near Lat. 18°N and Long. 86.5°E. With the formation of the depression, the upper winds along Orissa coast backed from east to northeast or north while the northwesterlies and westerlies along Circars-Coromandel coast strengthened considerably. Widespread and locally heavy rain occurred along Orissa and the north Circars coasts. The shallow depression moved in a northwesterly direction without intensification and was centred near Lat. 19.0°N and Long. 86.0°E at 0830 hrs. IST of 25th, when the pressure departure at the centre of the depression was estimated to be about -6 mbs. At 0530 hrs. IST, S. S. Maharaja (Lat. 18.7°N, Long. 89.7°E) reported a southerly wind of 15 knots and at 0830 hrs. IST, Sandheads reported a southeasterly wind of 15 knots. Puri northeasterly wind of 5 knots and drizzle. Gopalpur a northerly wind of 5 knots and continuous drizzle and Calingapatam a westsouthwesterly wind of 4 knots. 4" of rain fell at Gopalpur during 24 hours

ending at 0830 hrs. IST of 25th. Continuing to move in a northwesterly direction, the shallow depression weakened and on the evening of 25th lay as a 'low' over coastal Orissa and adjoining northwest Bay of Bengal.

The depression was responsible for a general strengthening of the monsoon over the Peninsula and in Orissa and Madhya Pradesh between the 23rd and 25th.

4. Depression in the Bay of Bengal—27th to 28th June 1955.—The residual "low" associated with the previous depression extended eastwards under the influence of a fresh easterly wave and a depression again formed on the morning of 27th with its centre at 0830 hrs. IST near Lat. 20.5°N, Long. 89.0°E. The following observations of the 27th are significant.

TABLE 8

Name of Station.	Hr. of obsn. IST.	Wind		Weather remarks.
		Dirrec-tion.	Speed (kts).	
Cox's Bazar . . .	0830	SE .	5	Slight intermittent rain.
Chittagong . . .	0830	SE	9	
Saugor Island . . .	0830	NE	18	
Balasore . . .	0830	NE	13	
Puri . . .	0830	WSW	5	Slight continuous rain.

At 0830 hrs. IST of 27th, pressure departure along the coast of East Pakistan, West Bengal and Orissa was -5 to -9 mbs. and pressure fall since 1730 hrs. IST of 26th (corrected for diurnal variations) about 3 mbs. Widespread and locally heavy to very heavy rain was reported from Orissa—West Bengal coast. The depression moved in a westnorthwesterly direction and was centred near Lat. 21.0°N and Long. 88.0°E at 1730 hrs. IST of 27th when the pressure departure at the centre of the depression was estimated to be about -9 mbs. A rise of pressure was observed over East Pakistan and adjoining West Bengal coast and a fall over the north Orissa coast. An active front directed towards northwest from the centre of the depression was also noticeable. Continuing to move in a westnorthwesterly direction, the depression crossed the north Orissa coast by the early morning of the 28th and lay as a low pressure area over Chota Nagpur and adjoining Orissa at 0830 hrs. IST on 28th. Thereafter, it weakened further and merged into the seasonal trough. Under the influence of the depression, the monsoon was active over Orissa, Gangetic West Bengal and the central parts of the country from the 27th to 29th.

5. Depression in the Bay of Bengal—23rd August to 1st September 1955.—On the morning of 23rd August, a general fall of pressure was noticed over the region extending from central Burma to Uttar Pradesh. By the next morning, the pressure fall became well marked over Orissa—north Circars coast and the monsoon trough extended into the northwest Bay of Bengal. Westerlies and southwesterlies over south Circars—Coromandel coast strengthened and southerlies along West Bengal

and East Pakistan coasts backed to southeasterlies. By the evening of 24th, conditions became unsettled over north-west Bay with associated upper air cyclonic circulation extending upto 10,000 ft. a.s.l. By the 25th morning, the unsettled conditions developed into a depression, with its centre at 0530 hrs. IST near Lat. 18°N , Long. 87°E as the following observations indicated.

TABLE 9

Date	Name of Ship/ Station	Position		Hr. of Obsn.	Wind.		Weather remarks
		Lat. $^{\circ}\text{N}$	Long. $^{\circ}\text{E}$		Direc- tion.	Speed (kts.)	
25-8-55	S.S. Jalakrishna	16.1	85.9	0530	W	25	Continuous slight drizzle.
Do.	S.S. Maharaja	20.0	88.5	0530	SE	10	
Do.	Sandheads			0530	ESE	10	

Pressure fall between 1730 hrs. IST of 24th and 0830 hrs. IST of 25th corrected for diurnal variation, was observed to be about 5 mbs. over south Orissa—north Circars coast, as against a rise of 1 to 2 mbs. in the Bay Islands, Chota Nagpur and interior of West Bengal; pressure departures at 0830 hrs. IST of 25th along Orissa Circars coast were -4 to -6 mbs. With the above developments, rainfall decreased over Chota Nagpur and inland districts of Gangetic West Bengal and north Orissa and increased over south Orissa and north coastal Andhradesa. The depression moved northwestwards without any intensification and was centred near Lat. 18.5°N and Long. 86.5°E at 1730 hrs. IST when S. S. Jagshanti (Lat. 17.0°N , Long. 84.2°E) reported westerly wind of 25 knots and rain; S.S. Maharaja (Lat. 18.2°N and Long. 89.3°E) reported southsoutheasterly wind of 10 knots and Gopalpur northnorthwest 4 knots and continuous slight rain. It continued to move in a northwesterly direction causing widespread and locally heavy to very heavy rain along Orissa—Circars coast and adjoining inland areas, Gopalpur recording 6" and Koraput 4" of rain during 24 hours ending at 0830 hrs. IST of 26th. The depression was centred at 0830 hrs. IST of 26th near Lat. 19°N and Long. 86°E as would be seen from the following observations—

TABLE 10

Date	Name of station/ ship	Position		Hr. of Obsn.	Wind		Weather remarks
		Lat. $^{\circ}\text{N}$	Long. $^{\circ}\text{E}$		Direc- tion	Speed (kts)	
26-8-55	S.S. Jalaprakah	19.5	86.1	0530	SSE	5	
Do.	S.S. Jagshanti	16.0	83.2	0530	W	35	
Do.	S.S. Maharaja	16.2	90.2	0530	S	27	

TABLE 10—contd.

Date	Name of Station/ ship	Position		Hr. of obsn.	Wind		Weather remarks
		Lat. $^{\circ}\text{N}$	Long $^{\circ}\text{E}$		Direc- tion	Speed (kts.)	
26-8-55	Calingapatam			0830	NNW	4	Intermittent moderate drizzle.
Do.	Gopalpur			0830	NNE	4	Continuous slight rain
Do.	Puri			0830	E	4	Intermittent slight rain.

An active front associated with a significant field of precipitation and a well marked field of negative pressure departure directed towards the west of the depression was noticeable. The depression then took a westerly course and moved slowly towards the coast. On the early morning of the next day (27th), the upper winds at Gopalpur veered from northeast to east and the surface wind was between northeast and eastnortheast. At 0830 hrs. IST, Puri reported east 20 knots, Gopalpur east-northeast 11 knots and slight rain and Calingapatam northnorthwest 4 knots. Gopalpur recorded the lowest pressure on Orissa—Circars coast, with a pressure departure of -8 mbs. At that hour, the depression was centred close to coast near Lat. 19°N and Long. 85°E . Widespread and locally heavy to very heavy rain was again reported from Circars and south Orissa coasts, north coastal Andhradesa and southeast Madhya Pradesh.

By the evening of 27th, the depression had crossed the coast near Gopalpur and moved westnorthwestwards. At 1730 hrs IST on this day, it was centred about 50 miles westnorthwest of Gopalpur. Thereafter, the depression moved in a northwesterly direction causing widespread and locally heavy rain over Orissa, Chota Nagpur and Madhya Pradesh. It lay over south Orissa on the morning of 28th with its centre at 0830 hrs. IST near Titilagarh. It weakened into a diffuse low on the next day, but was again accentuated by the approach of a fresh easterly wave with the result that an active low pressure area appeared over northeast Madhya Pradesh on the 30th morning. The low pressure area lay over Madhya Bharat on the 31st August. By the evening of 1st September it shifted to east Rajasthan and became unimportant by the next day.

The depression caused widespread rain with locally heavy to very heavy falls over the region extending from Orissa to east Rajasthan and north Gujrat during the period 24th August to 1st September. It also caused a strengthening of the monsoon in the Konkan, Deccan (Desh) and Hyderabad. Mahabaleshwar and Khandala had 19" of rain each between the 25th and 28th. According to press reports, heavy rains in the Godavari catchment during this period caused the river to rise dangerously and inundate vast areas of rich farm lands in West Godavari district submerging scores of villages in Bhadrachalam area. The following table gives the district averages and particularly heavy falls of rain associated with this depression. Rainfall figures for State raingauge stations in Orissa are not available.

TABLE 11

District	District averages on												Particularly heavy falls	
	August										September			
	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd		
Banaskantha	..	1.3	..	..	..	..	..	..	..	2.3	3.7	1.4	24th—Mount Abu 6.2". .. 1st—Dhanera 5.2", 2nd Mount Abu 6.5", Deodhar 6.7", Kankre 7.8".
Mehsana	..	2.2	..	..	..	..	..	..	..	2.4	2.5	..	24th—Mehsana 6.2", 1st Vijapur 11.4".
Sabarkantha	..	1.0	..	..	..	..	..	..	1.5	4.0	4.1	..	1st—Himatnagar 9.4", Mohanpur 6.8", 2nd Idar 6.0", Prantij 7.0", Vijayanagar 5.8", Meghraj 5.7", Bhiloda 5.1".
Ahmedabad	..	1.1	..	..	..	..	..	..	1.1	1.4	1.1	1.8	3rd—Kharaghoda 6.1".
Thana	1.2	5.3	2.8	..	1.8	1.3	..	..	..	2.3	1.8	1.2	23rd—Kalyan 7.5"; 24th Thana 5.2", Mokhada 7.0", Bhiwandi 5.4", Vada 5.2", Mahim 6.6", Dahanu 5.5", Borivali 7.1", Jawhar 8.4". 25th—Mokhada 6.6", Vada 5.3", Jawhar 7.1".
Bombay	1.4	4.1	4.6	..	..	2.5	..	..	..	2.6	1.1	1.0	
Kolaba	1.8	5.3	5.7	2.5	2.5	3.1	..	1.0	1.0	3.5	1.9	2.0	24th—Alibag 5.3", Panvel 7.3", Uran 5.0", Matheran 9.5", Murud 5.2". Sud- hagad 5.5", Mhasla 6.7". 25th—Alibag 5.8", Uran 5.5", Karjat 6.5", Matheran 6.9", Pen 6.3", Roha 7.5", Mangaon 7.4", Sudhagad 9.8". 26th—Murud 5.2". 28th—Panvel 7.0", Uran 5.3". 1st—Matheran 7.1".	
Ratnagiri	2.1	3.4	3.2	3.3	2.4	..	..	..	1.1	1.4	..	1.0	23rd—Chiplun 5.8", 24th Chiplun 7.8", 25th Chiplun 5.4", Khed 5.7", 26th Khed 5.7", Lanja 5.4".
Kanara	..	..	1.3	1.3	..	..	..	1.0	1.3	..	..	..
West Khandesh	..	1.2	..	..	..	..	..	..	1.1	1.3	..	..	1st—Dhadgaon 10.0".
East Khandesh	..	..	..	..	..	..	..	..	1.0	..	..	..
Dangs	..	2.5	5.6	..	..	..	..	..	..	..	4.9	1.5	25th—Waghai 5.8", Ahwa 5.3", 2nd Waghai 5.6".
Nasik	..	..	1.7	..	..	..	..	..	..	..	1.4	..	25th—Trimbak 6.1", Peint 5.4", Surgana 6.2"
Poona	..	..	1.0	1.1	..	..	..	..	..	1.2	..	..	25th—Lonavala 6.3", Khandala 7.1", 1st Lona- vala 6.2".
North Satara	..	..	..	..	..	..	..	..	..	..	..	..	24th—Mahabaleshwar 6.3", 25th Mahaba- leshwar 5.4". 26th—Mahabaleshwar 5.8".
Kolhapur	..	..	1.1	1.3	1.5	..	..	..	..	..	..	..	27th—Gaganbavada 5.0", Radhanagari 5.9".
Drug	..	..	..	..	..	..	1.2	..	..	..	..	..
Raipur	..	..	..	..	..	..	..	2.3	..	..	..	..	30th—Baloda Bazar 7.5", Arjuni 6.3", Lahood 8.0".
Bilaspur	..	..	..	..	..	..	..	1.7	..	..	..	..	29th—Dhabara 5.5", 30th Sheorinrayan 6.6".
Raigarh	..	1.0	..	..	..	..	..	2.4	..	..	..	..
Bastar	..	..	..	1.8	2.6	1.1	..	1.2	..	..	..	..	26th—Antagarh 5.6".
Surguja	..	1.3	..	..	..	..	..	..	..	..	..	..
Sagar	..	..	..	..	..	1.0	1.5	1.1	1.2	..	..	..	29th—Sagar (obsy) 5.3".
Jabalpur	1.5	..	..	..	..	..	1.2	..	..	..	..	..
Mandla	..	..	..	..	..	..	1.2	..	1.3	..	..	..	31st—Narayanganj 5.9".
Chanda	..	..	..	1.6	2.1	1.7	..	1.0	..	..	..	..	27th—Garhchiroli 6.9", Kunghari 7.1".
Bhandara	1.2	..	..	..	..	1.4	..	..	..	..	..	..
Balaghat	..	1.0	..	..	..	1.9	1.1	1.3	1.3	..	..	..	28th—Balaghat 5.3".

TABLE 11—*contd.*

District Averages on													
District	August									September			Particularly heavy falls
	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	
Hoshangabad	1.7	1.1	2.8	..	..	..	31st—Powarkheda 6.2".
Nimar	1.4	2.0	..	..	..
Betul	1.0	..	..	..	..
Chhindwara	1.1	1.0	..	..	..	1.2	1.2	1.2	1.3	..	..	..	31st—Amarwara 5.1".
Wardha	1.8	..	..	..	..
Nagpur	1.3	..	..	..	..	..	..
Akola	1.3	1.6	..	..	..
Amravati	1.6	1.6	..	..	..	28th—Chikalda 5.2".
Buldhana	1.4	1.2	..	..	..

6. Cyclonic storm in the Bay of Bengal—31st August to 7th September 1955.—Even when the residual low pressure area of the previous depression was lying over Madhya Bharat and before the general pressure fall over the country associated with the depression could recover completely, a fresh low pressure wave was noticed to be moving westwards across central Burma on the 31st August. By the morning of 1st September, the low pressure wave moved into the north Bay of Bengal and caused a general strengthening of the monsoon. Widespread and locally heavy to very heavy rain occurred along the Arakan—Chittagong coast and in Deltaic Burma; Akyab reported 7", Cox's Bazar 5" and Sandoway 4" of rain. There was a fall of pressure over the head of the Bay and a rise of pressure over the Circars and south Orissa coasts. By the evening of 1st, a well marked upper air cyclonic circulation extending upto 15,000 ft. a.s.l. developed over the northeast Bay and neighbourhood. On the morning of 2nd, a depression had formed with centre at 0830 hrs. IST near Lat. 21.5°N and Long. 89.5°E. At that hour, Sandheads reported westerly winds 19 knots and moderate intermittent rain, Saugor Island northnorthwest 18 knots and slight intermittent drizzle, and Cox's Bazar southeast 7 knots and slight continuous rain. The pressure continued to fall over the head of the Bay and also commenced falling along the Orissa coast, the departure of pressure from the normal over these areas being -5 to -7 mbs. During the course of the day, the depression moved westwards causing an increase in precipitation along coastal West Bengal and in north Orissa. It was centred near Lat. 21.5°N and Long. 88.5°E at 1730 hrs. IST when Saugor Island reported northnortheast wind of 18 knots and Sandheads westnorthwest 25 knots and heavy continuous rain. Moving westwards, the depression intensified rapidly into a cyclonic storm of small extent and was centred at 0130 hrs. IST of 3rd near Lat. 21.5°N and Long. 88.0°E. The following observations are significant.

TABLE 12

Name of Station	Date	Hr. of Obsn. IST.	Wind Direc- tion	Speed (kts)	Weather remarks
Sandheads	2-9-55	2330	WNW	30	Moderate continuous rain.
	3-9-55	0530	WSW	25	
Saugor Island	3-9-55	0130	NNE	20	Slight continuous rain.
Calcutta (Dum Dum)	2-9-55	2330	ENE	15	Drizzle.
	3-9-55	0130	ENE	25	
	3-9-55	0530	E	25	Slight intermittent drizzle.

The storm approached the north Orissa coast and was centred close to the north of Balasore at 0830 hrs. IST. At that hour, Sandheads reported west 25 knots, Saugor Island southwest 31 knots, Calcutta (Dum Dum) eastsoutheast 20 knots and Balasore west 9 knots. Upper winds over Calcutta were at this time southeasterly 40-45 knots upto 3,000 ft. a.s.l. The barometric pressure at Balasore was 993 mbs, about 11 mbs below normal. Widespread and locally heavy to very heavy rain occurred in north Orissa and adjoining West Bengal, Chandbali reporting 7" Sambalpur 6" and Balasore 5" at 0830 hrs. IST on the 3rd. The storm weakened into a deep depression and passed inland during the forenoon of the day. Moving westnorthwestwards thereafter, it was centred at 1730 hrs. IST, about 40 miles to the south-southeast of Chaibasa. On the 4th morning, the

TABLE 13—*contd.*

District	District averages on										Particularly heavy falls
	Aug.		September.								
	31	1	2	3	4	5	6	7	8	9	
	"	"	"	"	"	"	"	"	"	"	
Muzaffarnagar	3.8	On 9th-Kairana 5.6", Buldhana 5.1".
Meerut	3.3	On 9th-Sardhana 6.3"
Bulandshahr	3.1	
Aligarh	2.6	On 9th-Balanpur 5.0".
Mathura	2.2	
Bijnor	3.5	
Moradabad	2.0	
Nainital	1.3	
Almora	1.3	..	
Tehri Garhwal	1.0	..	1.1	..	

7. Shallow depression in the Bay of Bengal—21st to 26th September 1955. --On the morning of 21st September, a low pressure area was observed over the north Bay of Bengal and adjoining central Bay with the associated upper air cyclonic circulation extending upto 7,000 ft. Pressure was falling along Orissa and West Bengal coasts and rising along the Arakan coast. Pressure continued to fall rather rapidly along Orissa coast during the course of the day and by the evening the low pressure area concentrated into a shallow depression centred at 1730 hrs. IST near Lat. 19.5°N and Long. 87.0°E. The pressure departure on the Orissa coast was about -3 to -5 mbs. The shallow depression moved rapidly westwards and passed inland between Gopalpur and Puri at about 0130 hrs. IST of 22nd. Thereafter, it moved westnorthwest and was centred at 0830 hrs. IST of 22nd near Titilagarh. An active front directed towards westnorthwest from the centre of the depression was also noticeable. The shallow depression continued to move westnorthwest and lay over northwest Madhya Pradesh on the morning of 23rd with its centre

near Sagar. Widespread and locally heavy rain occurred over the central parts of the country on the 23rd. Thereafter the shallow depression weakened into a low pressure area which moved across northwest Madhya Pradesh and west Uttar Pradesh during the course of the next two days and broke up over the Punjab-Kumaon hills by the 26th. In association with this, widespread and locally heavy to very heavy rain occurred in west Uttar Pradesh and the Punjab (I) from the 24th to 26th. Dharampore and Chandigarh reported 8" of rain each on 26th. Meerut and New Delhi 6" each on 25th and Aligarh and Nainital 4" each on the 25th. According to press reports, the heavy rains in northwest Uttar Pradesh caused flooding of low lying areas, disruption of communications and collapse of many houses.

The following table gives the district averages and noteworthy amounts of rainfall in association with the depression. Rainfall figures for State rain gauge stations in Orissa are not available.

TABLE 14

..	District	District averages on						Particularly heavy falls	
		21	22	23	24	25	26		
	Drug . . . . .	..	..	1.9	..	..	..
	Raipur . . . . .	..	..	2.1	..	..	..
	Chhindwara . . . . .	..	..	1.4	..	..	..
	Amravati . . . . .	..	..	..	..	..	..	On 24th-Amravati	5.5".
	Saharanpur . . . . .	..	..	..	1.8	2.8	..		
	Muzaffarnagar . . . . .	..	..	..	2.7	5.5	1.3	25th—Muzaffarnagar 5.2", Kairana 8.5", Jeoli. Jansath 5.8", Bhainswal 5.0".	
	Meerut . . . . .	..	..	..	2.1	4.9	..	25th—Meerut (Obsy) 5.6", Mawana 7.6", Dasna 5.5".	
	Bulandshahr . . . . .	..	..	..	4.0	2.8	..	24th—Bulandshahr	9.3".
	Aligarh . . . . .	..	..	..	3.7	2.3	..	24th—Khair 5.6", Igla 5.3", Hathras 5.2", 25th-Balanpur 6.0".	
	Mathura . . . . .	..	..	..	3.5	1.0	..	24th—Chhotakosi	5.0".

TABLE 14—*contd.*

District	District averages on						Particularly heavy falls
	21	22	23	24	25	26	
	"	"	"	"	"	"	
Agra	2.8	1.3	..	
Bareilly	2.4	..	25th—Nawabganj 5.0", Kundhra 5.0".
Bijnor	4.3	..	25th—Bijnor 7.3".
Budaun	1.2	..	
Moradabad	4.0	..	25th—Morabadad 5.2".
Shahjahanpur	3.2	1.2	25th—Pawyan 5.1". Khutar 5.2".
Pilibhit	6.6	1.3	25th—Pilibhit (city) 7.7", Pilibhit (Cutcherry) 6.3", Bilaspur 7.0", Puraipur 7.4".
Nainital	2.8	..	
Almora	1.5	..	
Lucknow	1.7	
Hardoi	1.1	1.0	
Kheri	1.5	1.9	25th—Muhammd 5.1".
Bahraich	1.3	
Sultanpur	1.3	
Barabanki	2.0	

8. Cyclonic storm in the Bay of Bengal—28th September to 5th October 1955.—On the 28th September, a low pressure wave was observed to be moving westwards across central Burma. In association with it, upper winds over the Bay Islands and deltaic Burma strengthened and widespread rain occurred over these areas. By the next morning, conditions became markedly unsettled in east central Bay with the associated upper air circulation extending upto 10,000 ft. a.s.l. At 0830 hrs. IST Sandheads reported northerly winds 5 knots and rain in last hour; Akyab easterly 9 knots and slight drizzle and Bassein southeasterly 25 knots. By 1730 hrs. IST of the day, a pressure fall with increased precipitation was observed over Orissa and coastal West Bengal and a pressure rise with decreased precipitation over coastal Burma. No ships' observations were available from central Bay of Bengal but the afternoon upper wind observations of coastal stations showed that a depression had formed with its centre at 1730 hrs. IST near Lat. 18.0°N and Long. 90.0°E. At 3,000 ft. a.s.l. Calcutta reported eastnortheast 10 knots, Gopalpur northnortheast 10 knots, Port Blair southwest 25 knots and Akyab southeast 23 knots. The depression moved northwest and intensified rapidly in the course of the night. By the morning of 30th, it had become a cyclonic storm, centred at 0830 hrs. IST near Lat. 19.5°N and Long. 88.0°E as will be evident from the following observations:

TABLE 15

Name of ship/Station	Position		Hr. of obsn.	Wind	Weather remarks
	Lat. °N	Long. °E		Dirac-tion	
S.S. Jalakirti . . .	19.7	90.4	0530	SE	25
S.S. Jalakirti . . .	19.3	90.2	0830	SSE	25

TABLE 15—*contd.*

Name of Ship/Station	Position		Hr. of obsn.	Wind	Weather remarks
	Lat. °N	Long. °E		Dirac-tion	
S.S. Glen Maclean . .	20.3	90.8	0700	SE .	30
S.S. Jagtara	19.7	86.8	1030	NNW	25 Showers in last hour.
Sandheads			0830	SE .	13 Drizzle.
Saugor Island			0830	ESE (gusty)	22 Continuous rain.

The estimated pressure at the centre of the storm was 992 mbs. and the pressure deficiency about 16 mbs. An extensive area comprising north coastal Andhradesa, Orissa and adjoining Chota Nagpur and Gangetic West Bengal was experiencing continuous precipitation since the previous night. Saugor Island reported 5", Chandbali 4" and Midnapore 3" on the 30th morning. A brisk fall of pressure amounting to 4-6 mbs. since the previous evening (corrected for diurnal variation) was observed along the Orissa coast. Easterly upper winds over Calcutta strengthened considerably and reached 70 knots at 2,000 and 3,000 ft. a.s.l. Continuing its northwestward movement, the cyclonic storm approached north Orissa coast towards the evening of 30th when it showed signs of weakening. At 1430 hrs. IST S. S. Jagtara (Lat. 20.0°N and Long. 87.0°E) which was within 50 miles of the storm centre reported southsouthwesterly winds 25 knots and moderate intermittent rain. The following observations of 30th evening indicate that the cyclonic storm had weakened into a deep depression and was crossing north Orissa coast at 1730 hrs. IST near Lat. 20.5°N between Puri and Chandbali;

TABLE 16

Station	Hr. of obsn. IST	Wind		Weather Remarks
		Dirac-	Speed	
		tion	(Kts.)	
Sandheads	1730	SE .	18	Moderate continuous rain.
Saugor Islands	1730	ESE	23 (Gusty)	Slight intermittent rain.
Gopalpur	1730	W .	4	
Puri	1730	SSW	14	
Chandbali	1730	SE .	23	Slight intermittent rain.
Balasore	1730	SE .	11	Rain during last hour.

After crossing coast, the deep depression moved west-northwestwards across Orissa and lay over east Madhya Pradesh with its centre at 0830 hrs. IST of 1st October, near Raigarh. The pressure deficiency at the centre of the depression was estimated to be about 12 mbs. and the associated upper air circulation was extending at least upto 15,000 ft. a.s.l. The deep depression, without showing any signs of weakening, continued to move west-northwestwards and lay over west Madhya Pradesh on the 2nd morning, with its centre at 0830 hrs. IST near Sagar. By the 3rd morning, it had reached southeast Rajasthan with its centre near Jhalawar. Remaining practically stationary there, the deep depression became still more active until the afternoon of 4th as a result of fresh monsoon air from the Arabian Sea feeding into it. Thereafter, it weakened into a depression and moved northwards under the influence of a deep westerly wave which was moving eastwards across Jammu and Kashmir. On the morning of 5th, it lay over the Punjab (I) and by the 6th it broke up over the Punjab hills.

The depression caused a general revival of the monsoon and widespread and locally heavy to very heavy rain occurred along and near its track during the period 1st to 6th October. Under the combined influence of the depression and the westerly wave mentioned above, well-marked convergence developed over the Punjab (I) into which a vigorous current of moist air was fed. Ambala reported southerly winds of 85 knots at 3,000 ft. a.s.l. on the afternoon of 3rd. The moist flow was maintained during the next day also when Ambala reported southeasterly winds of 72 knots at 3,000 ft. a.s.l. and in consequence there was widespread very heavy rain over the Punjab(I) from 3rd to 5th, the rainfall being exceptionally heavy at some places. Ludhiana recorded 14" of rain and Dalhousie 11" in 24 hours ending at 0830 hrs. IST on the 4th. At six rain gauge stations in the Punjab(I), the rainfall during 48 hours exceeded 20 inches. Falls of 10 inches or more in 24 hours occurred at 17 stations. Due to the torrential rains, Punjab and PEPSU States came under the grip of severe floods which, according to press reports, were the most disastrous in recent history. Thousands of villages were reported to have been isolated from the rest of the country and food supplies had to be air-dropped by the Indian Air Force personnel at many places. Hundreds of houses collapsed in the cities and towns of the Punjab(I) and a large number of people were reported to have been killed or seriously injured. The waters of river Jamuna near Delhi rose to a dangerous level and thousands of people residing on its banks in the neighbourhood of Delhi had to seek shelter inside the city. On 8th October, the city of Delhi itself was threatened by the rising waters of Jamuna, which according to press reports, reached a record level on the 9th morning and then subsided. According to a statement issued by the Chief Minister of Punjab, 7,000 out of the State's 75,000 villages were inundated, 75,000 houses destroyed and cash crops worth 35 crores of rupees damaged by the floods. The total death roll on account of the floods and house collapses was estimated to be about 1500 according to newspaper reports.

The following table shows the district averages and noteworthy amounts of rainfall associated with the storm:

TABLE 17

District	District averages on								Particularly heavy falls
	September			October					
	28	29	30	1	2	3	4		
	"	"	"	"	"	"	"		
Drug	1st—Adamabad 5'5".	
Raipur	1st—Lakholi 5'4", Rudri 5'1", Bhatgaon 6'8", Kondapur 5'7", Kendri 5'3".	
Bilaspur		
Raigarh		
Bastar		
Chanda	2nd—Asola 5'7".	
Bhandara	3rd—Khyrbund 5'0".	
Balaghat		

TABLE 17—*contd.*

District	District averages on									Particularly heavy falls		
	September			October								
	28	29	30	1	2	3	4	5	6			
	"	"	"	"	"	"	"	"	"			
Hoshangabad	2.3	1.1	.	.	.	2nd—Pachmarhi (Obsy.) 6.5".	
Betul	2.1	.	1.2	.	.		
Chhindwara	1.9	.	.	.	.	2nd—Tamia 6.8"	
Wardha	1.0	.	1.5	.	.		
Nagpur	1.7	.	.		
Akola	1.0	.		
Amravati	1.3	.	.		
Yavatmal	2.4	.	.	.		
Hissar	1.9	1.7		
Gurgaon	1.0	.		
Karnal	2.7	1.1		
Ambala	2.8	2.8	2.2	
Simla	1.3	1.7		
Kangra	2.3	5.1	5.0	2.1	3rd—Dharamsala (lower) 7.2", Gondla (obsy.) 5.7". 4th—Hamirpur 6.0", Dehra 7.2", Kangra 7.2", Dharamsala (lower) 6.5", Nurpur 6.0", Dharamsala (Obsy.) 7.7", Gondla (obsy.) 6.3". 5th—Dehra 5.9", Kangra 6.4", Nurpur 11.5", Dharamsala (Obsy.) 6.4", Koksar (obsy.) 6.6", Gondla (Obsy.) 5.8".
Hoshiarpur	1.2	8.3	6.9	3.6	3rd—Dasuya 6.3", Una 10.6", Garhshankar 10.0", Hoshiarpur 9.7". 4th—Dasuya 8.9", Una 7.2", Garhshankar 5.1", Hoshiarpur 8.2". 5th—Una 6.7".
Jullundur	1.1	7.5	5.2	.	4th—Jullundur 7.0", Phillaur 11.5", Nawanshahr 7.2". 5th—Jullundur 6.6", Nakodar 5.7".
Ludhiana	1.0	8.3	6.2	.	4th—Samrala 6.1", Ludhiana 11.4", Jagraon 7.5". 5th—Jagraon 11.5"
Ferozepore	2.8	3.3	.	4th—Moga 6.6", Nathana 9.0". 5th—Moga 13.2", Zira 6.6", Jaiwalwala 8.2".
Amritsar	6.5	8.9	1.1	4th—Khara 10.3", Raya 7.2", Amritsar Jail Hospital 7.7", Amritsar 5.7", Amritsar (obsy.) 7.5", Ajnala 6.0", Patti 5.9". 5th—Bhuchar 7.1", Khara 18.0", Tara Taran 6.9", Raya 14.5", Amritsar Jail Hospital 9.0", Amritsar 6.0", Amritsar (Obsy.) 5.4", Ajnala 5.4", Patti 7.3".
Gurdaspur	7.3	12.6	3.7	4th—Aliwal 7.0", Batala 8.5", Tibri 6.8", Gurdaspur 9.9", Pathankot 5.3", Dalhousie (Obsy.) 10.8", Madhopur 5.7". 5th—Aliwal 19.5", Batala 18.7", Tibri 10.2", Gurdaspur 14.6", Pathankot 8.3", Dalhousie (Obsy.) 11.3", Madhopur 13.8". 6th—Batala 5.3", Pathankot 5.5", Malikpur 5.0".

9. Shallow depression in the Bay of Bengal—13th to 17th October 1955.—On the evening of 13th October, a low pressure wave was observed moving westwards across the south Andaman Sea. Pressures were falling and fairly widespread rain occurred over the Bay

Islands. By the next morning, the low pressure wave entered the southeast Bay of Bengal and became well marked. The upper winds at Port Blair upto 2,000 ft. a.s.l. which were north/northeast 10 to 15 knots on the evening of 13th, veered to southeast and strengthened

to 25 knots on the 14th morning. The well marked low pressure area persisted over the southeast Bay of Bengal on the 14th and conditions became markedly unsettled there on the morning of 15th. when a rise of pressure was observed over the Bay Islands and a fall over Ceylon and Circars coasts. The unsettled conditions developed into a shallow depression on the evening of 15th, when it was centred near Lat. 11.5°N and Long. 86.5°E . The following observations are relevant in this connection:

TABLE 18

Date	Name of station/ ship	Position		Hr. of obsn. IST	Wind		Weather remarks
		Lat. °N	Long. °E		Direc- tion.	Speed (Kts.)	
15-10-55	S. S. Meerkerk	9.9	86.7	1730	W	8	Showers during the preceding hour.
Do.	S. S. Matheran	9.7	83.1	1730	WNW	8	
Do.	S. S. Bharatvijaya	13.2	83.3	1730	NE	28	

The shallow depression moved rapidly westnorthwestwards and lay near Lat. 13.0°N and Long. 83.5°E at 0830 hrs. IST of 16th. At 0530 hrs. IST of the same day, S. S. Bharatvijaya (Lat. 13.5°N and Long. 84.5°E) reported eastsoutheast 6 knots and S. S. Jalaprakash (Lat. 15.6°N and Long. 82.8°E) northeast 4 knots and slight drizzle while at 0830 hrs. IST Madras reported northwest 7 knots. The estimated pressure deficiency at the centre of the depression was 7 mbs. on that morning. Thereafter, the shallow depression moved northwest till the morning of 17th when it was centred near Lat. 15°N and Long. 81°E . The pressure departure along north Coromandel and south Circars coasts was only - 2 to - 3 mbs. showing that the depression was becoming unimportant. Fairly widespread and locally heavy rain was reported on this morning from Circars coast and adjoining areas. Masulipatam reported 5" of rain and Gopalpur 3" during 24 hours ending at 0830 hrs. IST of 17th. By the afternoon of 17th, the depression had diffused and lay as a low pressure area over the south coastal Andhradesa and adjoining areas.

10. Severe cyclonic storm in the Bay of Bengal—4th to 14th October 1955.—A low pressure wave from the east was observed to be moving into the south Andaman Sea on the 4th October when widespread thunder-rain occurred over the Bay Islands, Car Nicobar reporting 2". Pressures started falling over the Bay Islands on the 5th morning and an upper air cyclonic circulation extending upto 5,000 ft. was developing over the Andaman Sea and neighbourhood. By the evening of 5th, conditions became markedly unsettled in the north Andaman Sea and by the next morning, a depression formed with its centre at 0830 hrs. IST near Lat. 13.5°N and Long. 91.5°E . The following observations of 6th are relevant in this connection:

TABLE 19

Name of Ship/ Station	Position		Hr. of Obsn. IST	Wind		Weather remarks
	Lat. °N	Long. °E		Direc- tion.	Speed (Kts.)	
Port Blair			0530	SW	15	Slight continuous rain.
Port Blair			0830	W	17 (gusty).	

TABLE 19—contd.

Name of Ship/ Station	Position		Hr. of Obsn. IST	Wind		Weather remarks
	Lat. °N	Long. °E		Direc- tion	Speed (Kts.)	
Long. Island			0830	SW	5	
Maya Bandar			0830	SW	5	
Table Island			0830	ESE	5	
S.S. Shinwa Maru	12.3	94.8	0530	S	12	

The estimated pressure at the centre of the depression was 1002 mbs., about 9 mbs. below normal.

Moving northeastwards the depression was centred at 0830 hrs. IST of the 7th near Lat. 15.0°N and Long. 92.0°E as indicated by the following observations of the 7th:

TABLE 20

Name of Ship/ Station	Position		Hr. of Obsn. IST	Wind		Weather remarks
	Lat. °N	Long. °E		Direc- tion	Speed (Kts.)	
S.S. Shinwa Maru	15.8	91.3	0530	E	19	
S.S. Shinwa Maru	16.1	92.0	0830	ESE	19	
Table Island			0830	SSW	5	
Mayabandar			0830	WSW	15	Drizzle.
Port Blair			0830	WSW	20	Continuous rain.

The depression continued to move northeastward but with reduced speed and intensified at the same time. On the morning of the 8th, it lay as a deep depression with its centre at 0830 hrs. IST near Lat. 15.5°N and Long. 92.5°E . Mayabandar reported westsouthwesterly wind, 25 knots and S. S. State of Andhra which was about 170 miles to the northnorthwest of the centre of the depression reported northeast 24 knots at 1130 hrs. IST. The deep depression remained stationary during the course of the day and intensified into a cyclonic storm of small extent by 1730 hrs. IST of 8th. The following observations of 8th are of interest in this connection:

TABLE 21

Name of ship	Position		Hr. of Obsn. IST	Wind		Weather remarks
	Lat. °N	Long. °E		Direc- tion	Speed (Kts.)	
S.S. State of Andhra	15.9	92.6	1730	NE	30	
S.S. Maharaja	14.0	92.3	1730	WSW	16	
S.S. Warara	18.9	93.2	1730	E	27	Rain in sight.
S.S. Warara	17.7	93.5	2030	E	30	

The estimated barometric pressure at the centre of the storm now was about 994 mbs. and the pressure deficiency about 15 mbs.

The cyclonic storm thereafter recurved to the north-west. At 0830 hrs. IST of the 9th, it was centred near Lat. 17.0°N and Long. 91.0°E. Owing to absence of ship's observations, the positions of the storm on the 9th evening and night cannot be fixed with certainty. But from a pressure rise of 2 to 3 mbs in 24 hours observed over Arakan coast and deltaic Burma and a pressure fall of 1 to 2 mbs over south Orissa, the storm appears to have moved rapidly westnorthwest and at 0830 hrs. IST of the 10th was located with centre near Lat. 17.5°N and Long. 87.5°E. The following observations of 10th are significant.

TABLE 22

Name of station/ship	Position, Hr. of obsn.		Wind		Weather remarks
	Lat. °N	Long. °E	Dir.	Speed (kts)	
Sand heads			0530 E	20	
S.S. Shahjahan	16.4	86.2	0530 WNW	24	Moderate rain.
S.S. Shahjahan	16.7	86.3	0830 WNW	35	Slight intermittent rain.
S.S. Loksang	18.8	89.9	0530 ESE	25	Heavy intermittent rain.

During the course of the day, the storm became severe as will be evidenced by the following hourly observations recorded by S. S. Shahjahan which was about 80 to 100 miles away from the storm centre. The estimated lowest pressure at the centre of the storm on that day was 985 mbs and the pressure deficiency about 24 mbs.

TABLE 23

TABLE SHOWING HOURLY OBSERVATIONS RECORDED BY S. S. SHAHJAHAN
DATE 10-10-1955.

Hour IST	Barometer reading (Corrected)	Wind		Remarks about swell
		Direction	Force	
0600	1000.1	NW	7	
0700	999.7	NW	6	
0800	999.1	WNW	8	
0900	997.8	WNW	8	
1000	994.9	W 1/2 N	8	
1100	992.7	W	9	
1130	992.8	W	9	
1200	992.4	WxS	8	
1230	991.6	WxS	9	
1300	991.6	WxS	9	
1330	991.6	WxS	9	1637 N 8640 E— Heavy swell Nx E.
1400	993.2	WSW	8	Heavy swell Nx E.
1500	996.1	SWxW	8	Heavy swell North.
1600	997.7	SW	8	Heavy swell Nx W.
1700	997.6	SW	6	Heavy swell NWx W.
1800	999.4	SW	6	Heavy swell NWx W.

TABLE 23—contd.

Hour IST	Barometer reading (Corrected)	Wind		Remarks about swell
		Direction	Force	
1900	1001.7	SSW	6	
2000	1002.5	SSW	6	
2100	1002.7	S	5	
2200	1003.8	SSE	5	
2300	1003.8	Sx E	5	
2400	1003.7	Sx E	5	
11-10-1955				
0100	1004.2	SE	5	

The following extracts from the log of S. S. Shahjahan will also be of interest.

Time 1330 hrs. IST.—"Typical conditions; completely overcast with continuous rain and frequent succession of heavier squalls, reducing visibility to less than 250 yds. Fast moving scud cloud when observable. Definite heavy swell from N x E predominating with confused sea across swell from changing wind direction."

The severe cyclonic storm was centred at 1730 hrs. IST of 10th within half a degree of Lat. 18.0°N and Long. 86.0°E and was moving westnorthwest. At that hour, S. S. Shahjahan (Lat. 16.7°N and Long. 87.0°E) reported southwesterly winds 30 knots and Puri east-northeast 15 knots. Upper winds upto 3,000 ft. a.s.l. at Cuttack were east-northeast to easterly 40-50 knots. The storm crossed coast close to Calingapatam at about 0200 hrs. IST of 11th. The following information was gathered from the Port Conservator, Calingapatam and his staff by Sri N. S. Bhaskara Rao, an officer of this department.

".....winds must have been of the order of 40 knots or more during the period 01 hrs. to 03 hrs. IST. The maximum speed of 60 or even 70 knots must have been reached during the period 01-30 to 0200 hrs. of 11th. The wind direction was westnorthwest until 0200 hrs. Then there was a sudden drop in speed with a nearly calm period for 2-3 minutes. Then it blew from an east-southeast direction and rapidly reached gale force. Gales continued upto 0300 hrs. and thereafter the winds gradually subsided....."

From the above description of weather at Calingapatam, the storm appears to have crossed the coast over or very near to that place. The barograph at Calingapatam recorded a fall of pressure of 19 mbs. between 21 hrs. IST of the 10th and 0230 hrs. IST of 11th. The lowest pressure of 979 mbs was attained at about 0230 hrs. IST, about 30 mbs below normal.

A large number of trees were reported to have been uprooted by the storm in Srikakulam district and the northern half of Visakhapatnam district. Telecommunications over this area were completely disrupted as a result of the storm and heavy rains.

After crossing coast, the storm weakened into a deep depression and moved rapidly northwestwards, causing widespread and locally heavy to very heavy rain along and near its track. At 0830 hrs. IST of the 12th, the

deep depression lay over north Madhya Pradesh with its centre close to Seoni. It then moved rapidly north-northwestwards and lay near Agra on the morning of the 13th. During the course of the day, it weakened further and was near New Delhi in the evening. By the next morning, it had broken up after further weakening, over the hills of northwest Uttar Pradesh. Under its influence, heavy to very heavy rain occurred at most places in central and west Uttar Pradesh, several stations recording rainfall ranging from 6 to 12 inches on the 13th. These rains caused serious floods, since the rivers in the region were already in a swollen state due to heavy rains brought about by the cyclonic storm of 28th September to 5th October. Water levels in the rivers Ganga, Ramganga, Jamuna and Sarda were reported to have risen to unprecedented levels. The level of river Ganga overshot the danger mark at many places, particularly near Farrukabad. Hundreds of square miles of land was reported to have been submerged in one vast sheet of water and scores of villages were completely isolated from the rest of the country. Food had to be air dropped by the Indian Air Force personnel. The damage to crops in Uttar Pradesh was also reported to be heavy.

The statement showing the district averages and significant amounts of rainfall associated with the storm is given below:—

TABLE 24

District	District averages on				Particularly heavy falls
	11	12	13	14	
	"	"	"	"	
Bastar	2.1	..	..	..
Chanda	1.3	..	..	..	On 12th—Dhanora 6.2".
Bhandara	2.9	..	..	..
Chhindwara	1.6	1.2	..	..
Nagpur	1.0	..	..	..
Dehra Dun	1.4	1.8	..	..
Saharanpur	1.1	..	..	..
Muzaffarnagar	1.6	..	..	..
Meerut	2.5	..	..	..
Bulandshahr	2.4	1.2	..	..
Aligarh	4	5	..	..	On 13th—Aligarh (obsy.) 5.5", Khair 5.3", Atrauli 8.8".
Agra	2.7	..	..	..
Mainpuri	2.7	1.7	..	..
Etah	2.7	5.1	..	..	On 12th—Aliganj 5.2", 13th—Etah 5.3", Ali- ganj 8.3".
Bareilly	2.5	1.6	..	..	On 13th—Aonla 7.3".
Bijnor	3.3	1.2	..	..
Budaun	2.7	6.8	1.1	..	On 13th—Budaun 6.9", Bis- auli 11.8", Dataganj 6.1".
Moradabad	2.7	4.6	2.1	..	On 13th—Amroha 5.3", Sam- balpur 6.8", Bilari 6.0".
Shahjahanpur	1.5	1.8	2.4	..	
Pilibhit	1.6	..	1.7	..	
Farrukhabad	1.4	2.6	..	..
Etawah	1.8	2.9	..	..

TABLE 24—contd.

District	District averages on				Particularly heavy falls
	11	12	13	14	
	"	"	"	"	
Kanpur	2.9	..	
Fatehpur	1.3	..	
Jhansi	1.1	..	
Jalaun	1.1	1.1	..	
Hamirpur	1.4	..	
Nainital	4.9	1.5	..	On 12th—Nainital 6.1", Baz- pur 5.9", Gadarpur 5.5", Haldwani 6.8", Ramnagar 6.1", Kathgodam 7.9", Nainital (obsy.) 6.2".
Almora	2.9	1.7	1.4	
Garhwal	2.6	2.3	..	
Tehri Garhwal	1.6	1.2	..	
Hardoi	1.7	2.0	2.5	
Kheri	2.4	

11. Shallow depression in the Bay of Bengal—21st to 24th October 1955.—A low pressure wave moved into south Andaman sea across the Tennasserim coast on the 18th. With its arrival in the south Bay on the 19th, the seasonal low pressure area there got accentuated and there was a strengthening of both the branches of the monsoon by the 19th evening. Widespread rain was reported from Ceylon and the Andaman Islands on the 20th morning, when a trough of low pressure appeared over the southwest and adjoining west central Bay. The trough slowly shifted northwards intensifying at the same time. On the evening of 20th, the westerly winds over Ceylon strengthened considerably, Hambantota reporting a wind speed of 54 knots at 2,000 ft. a.s.l. On the morning of 21st, the trough became well marked and lay over the west central Bay. In association with it, widespread rain occurred in Orissa and the north Circars coast. By the 22nd morning, a shallow depression had formed with its centre at 0830 hrs. IST near Lat. 16.5°N and Long. 86.0°E. At 0530 hrs. IST of this day, S.S. Maharaja (Lat. 16.6°N and Long. 90.0°E) reported southeasterly winds 12 knots with moderate intermittent drizzle, and S.S. Bharat Raja (Lat. 19.8°N and Long. 87.7°E) eastsoutheasterly 10 knots.

Under the influence of the depression, widespread and locally heavy to very heavy rain continued along Orissa coast and adjoining areas. Gopalpur reported 6" and Puri, Cuttack and Chandbali 3" each on the 22nd. The shallow depression moved northeast and was centred at 1730 hrs. IST of the same day near Lat. 17.5°N and Long. 87.0°E. Thereafter it took a northerly course and lay at 0830 hrs. IST of the 23rd near Lat. 18.5°N and Long. 87.5°E. At that hour, Sandheads reported southeasterly winds 9 knots with moderate intermittent rain, and S.S. Shinwamaru (Lat. 19.7°N and Long. 89.3°E) reported southsoutheasterly winds 15 knots at 0530 hrs. IST. During the course of the day, the shallow depression moved further northwards, causing an extension of precipitation to Gangetic West Bengal, Assam and East Pakistan. At 1730 hrs. IST it was centred near Lat. 20.0°N and Long. 87.5°E. On the next morning it passed inland across coastal West Bengal as a shallow

low pressure area and moved away northeastwards as a low pressure wave during the course of the day. Fairly widespread rain with locally heavy to very heavy falls was reported from Orissa and Gangetic West Bengal on the 24th, Saugor Island recording 5" and Calcutta, Sandheads, Contai and Chandbali 3" each.

The pressure deficiency at the centre of the shallow depression was estimated to be 6 to 7 mbs from the morning of 22nd to the evening of 23rd.

12. Cyclonic storm in the Bay of Bengal—2nd to 9th November 1955.—A low pressure wave from the east moved westwards across the south Andaman Sea on the morning of 2nd November. Pressure departures over the Tennasserim and the Bay Islands were 4 to 6 mbs below normal. Widespread and locally heavy rain occurred in the Nicobar Islands, Car-Nicobar reporting 5" on the 2nd morning. The low pressure wave moved into the southeast Bay by the morning of 3rd when conditions became markedly unsettled there. On the same evening, a depression formed with its centre at 1730 hrs. IST near Lat. 9.0°N and Long. 92.0°E when S.S. Shahjahan (Lat. 8.6°N and Long. 89.7°E) reported northnorth-westerly wind 13 knots, S. S. Leicestershire (Lat. 12.2°N and Long. 90.4°E) northeasterly 15 knots and Nan Cowrie southwesterly 4 knots. The pressure deficiency at the centre of the depression was estimated to be about 8 mbs, the actual deficiency at Car Nicobar which was within 50 miles of the centre being about 7 mbs. Moving westnorthwest, the depression was centred at 0830 hrs. IST of the 4th near Lat. 9.5°N and Long. 90.5°E . Upper winds at 1,000 ft. over Port Blair were eastsoutheasterly 30 knots on that morning, while the surface winds at the same station were southeasterly 25 knots at 0830 hrs. IST. Widespread rain continued over the Bay Islands. The upper winds over the Tennasserim coast strengthened considerably during the course of the day, indicating intensification of the circulation, Tavoy reporting southeasterly 40 knots at 7,000 ft. a.s.l. on 4th afternoon. The depression became deep by the evening when it was centred near Lat. 10.0°N and Long. 89.0°E at 1730 hrs. IST.

During the course of the night, the deep depression moved in a northwesterly direction intensifying further into a cyclonic storm. It was centred at 0830 hrs. IST of 5th near Lat. 12.0°N and Long. 87.0°E . The following observations of the 5th are significant in this connection.

TABLE 25

Name of ship/ station	Position		Hr. of obsn. IST	Wind		Weather remarks
	Lat. $^{\circ}\text{N}$	Long. $^{\circ}\text{E}$		Dirac- tion	Speed (Kts.)	
S. S. Hellenes	11.5	84.7	0830	NW	30	Moderate rain and rough seas.
S. S. City of Calcutta.	11.6	82.5	0530	NW	20	Moderate continuous rain.
S. S. Hellenes	11.1	84.5	1130	NW	30	Squally weather.

From the wind speed of 30 knots reported by S.S. Hellenes which was about 150 miles away from the centre of the storm, it is concluded that winds nearer the centre reached a least 40 knots. The intensity of the

upper air circulation had increased considerably on the 5th, the northerly to northeasterly winds along the Circars and north Coromandel coasts being about 50 knots. The storm was centred at 1730 hrs. IST near Lat. 13.0°N and Long. 85.5°E . when S.S. Clan Cameron which was about 180 miles to the west of the centre reported north-northwesterly winds, force 7 B.F., frequent rainsqualls, rough seas and heavy confused swell. By that time, pressures had started rising over the Bay Islands and falling rapidly over the Circars coast. Precipitation also commenced along the north Coromandel and Circars coasts. Continuing to move northwest, the storm was centred at 0830 hrs. IST of the 6th within half a degree of Lat. 15.5°N and Long. 84.0°E . The following observations of the 6th are significant in this connection :—

TABLE 26

Name of ship/ station	Position		Hr. of obsn. IST	Wind		Weather remarks
	Lat. $^{\circ}\text{N}$	Long. $^{\circ}\text{E}$		Dir- rec.	Speed (Kts.)	
S. S. Choyasang	16.6	84.0	0530	ENE	37	Showery.
S. S. Bharat Raja	15.9	82.2	0530	N	25	Squally weather.
S. S. Jagganga	16.6	84.5	0530	ESE	44	Moderate continuous rain.

The pressure departure at Kakinada at 0830 hrs. IST was about 14 mbs, and the pressure reported by S.S. Choyasang at 0530 hrs. IST was 995 mbs, about 18 mbs below normal. The estimated pressure deficiency at the centre of the storm on the assumption that there was no calm centre was of the order of 20-25 mbs.

The cyclonic storm moved slowly northwards till 1730 hrs. IST of 6th when it was centred near Lat. 16.0°N and Long. 84.0°E . The following observations of the 6th help in fixing the centre.

TABLE 27

Name of ship	Position		Hr. of obsn. IST	Wind		Weather remarks
	Lat. $^{\circ}\text{N}$	Long. $^{\circ}\text{E}$		Dirac- tion	Speed (Kts.)	
S.S. Bharat Raja	14.4	82.4	1730	WNW	37	
S.S. Choyasang	15.7	83.5	1730	NNW	40	Showery.
S.S. Jagganga	14.8	85.0	1815	S	4 to 5 B.F.	Heavy swell and rough seas.
S.S. Jalapadma	17.7	84.3	1730	ENE	25	Heavy intermittent rain.

Thereafter, the storm started recurving to the northeast, weakening into a deep depression at the same time. At 0830 hrs. IST of 7th it lay as a deep depression near Lat. 17.5°N and Long. 84.5°E . The pressure deficiency at Visakhapatnam which was within 80 miles of the centre of the depression was still as high as 17 mbs but since the entire country was having pressures considerably below normal, the deficiency estimated with reference to the outermost closed isobar of the depression

was only about 9 mbs. The deep depression remained practically stationary till the evening of 7th, and weakening rapidly thereafter and continuing to move northeastwards lay as an elongated trough extending from the north Circars coast to the Sundarbans on the 8th morning. Widespread and locally heavy rain had by then extended into the whole of West Bengal and Assam. The trough gradually shifted northeastwards and eventually broke up over the hills of lower Assam by the 10th evening.

Under the influence of the storm, fairly widespread rain with a few heavy to very heavy falls was reported from Orissa, Chota Nagpur, Gangetic West Bengal and coastal Andhra Pradesh on the 7th and 8th. Some noteworthy amounts of rainfall recorded were—Balasore 5", Saugor Island, Sandheads and Baripada 4" each on the 7th and Gopalpur 7", Cuttack and Puri 4" each on the 8th.

13. Severe cyclonic storm in the Bay of Bengal—28th November to 2nd December 1955 (Tanjore cyclone).—

With the arrival of an easterly wave across the south Andaman Sea, the seasonal trough in the extreme south of the Bay of Bengal became accentuated on the morning of 27th. By the same evening, a well marked upper air cyclonic circulation developed over the southwest and adjoining southeast Bay between 5,000 ft. and 10,000 ft. a.s.l. On the morning of 28th, there was a fall of pressure over the southwest Bay and a rise of pressure elsewhere in the Bay as well as over the entire country. By the evening of 28th, a well marked trough of low pressure formed over the southwest Bay with an associated upper air circulation extending upto 10,000 ft. a.s.l. Early on the morning of 29th, upper winds at Madras and Tiruchirappalli backed to northnortheast and strengthened considerably. By 0830 hrs. IST of 29th, the well marked trough concentrated into a depression with its centre near Lat. 9.5°N and Long. 83.5°E as would be evident from the following observations of 29th.

TABLE 28

Name of Ship/ station	Position		Hr. of obsn. IST	Wind		Weather remarks
	Lat. °N	Long. °E		Direc- tion	Speed (Kts)	
S.S. Shahzada	10.0	84.0	0730	SE	25	Continuous heavy rain.
S.S. Jaladuta	9.9	82.0	1130	NNW	10	Moderate intermittent rain.
Jaffna	..	..	0830	NW	15	Showers.

Pressures were still falling over Ceylon and commenced falling in the extreme south Peninsula, while rising over the Bay Islands. The depression moved westnorthwest during the course of the day without any appreciable intensification and was centred at 1730 hrs. IST near Lat. 10.0°N and Long. 82.5°E. S. S. Padana (Lat. 9.5°N and Long. 82.1°E) reported westnorthwesterly winds force 5 B.F. at 1830 hrs. IST with moderate sea and northerly swell. The estimated pressure deficiency at the centre of the depression at this time was about 6 mbs. Fairly widespread rain had commenced in Ceylon and along the Coromandel coast. Moving now in a westerly direction, the depression became deep during the course

of the night and was centred at 0830 hrs. IST of the 30th near Lat. 10.0°N and Long. 82.0°E. The following observations of 30th are significant in this connection.

TABLE 29

Name of Ship/ station	Position		Hr. of obsn. IST	Wind		Weather remarks
	Lat. °N	Long. °E		Direc- tion	Speed (Kts)	
S.S. Padana	10.0	82.5	0830	SE	24	Heavy rain squall sea moderate, swell moderate.
S.S. City of Colchester	11.6	83.8	0530	E	25	..
Jaffna	..	..	0830	WNW	15	Continuous drizzle.
Nagapattinam	..	..	0830	NW	10	Intermittent rain.

The pressure departures over the extreme southeast of the Peninsula and over north Ceylon were negative with the maximum pressure deficiency of 2.5 mbs. at Nagapattinam, while the pressure departure over the rest of the country was positive. The pressure deficiency at the centre of the deep depression at 0830 hrs. IST based on the pressure value of 998 mbs reported by S.S. Padana was about 14 mbs. The upper winds at Madras had by now veered from northnortheast to east, while those at Trincomalee had backed from northwest to west. The intensity of precipitation along and near the south Coromandel coast had also increased. The deep depression then intensified rapidly into a cyclonic storm of small extent soon after the noon of this day. At 1045 hrs. IST S.S. Padana (Lat. 10.3°N and Long. 82.5°E) which was at a distance of about 50 miles to the northeast of the depression reported eastsoutheast winds—30 knots, heavy rain squalls, rough seas and moderate swell. At 1130 hrs. IST, S.S. City of Colchester (Lat. 10.6°N and Long. 83.5°E) reported southsoutheasterly winds 24 knots and heavy rain squalls and Nagapattinam reported north-northeasterly 25 knots and continuous moderate rain. The following half-hourly observations of Jaffna recorded on the 30th indicate the intensification and westward movement of the storm.

TABLE 30

Date	Hour of obsn. IST	Wind		Weather remarks
		Direction	Speed (Kts.)	
30-11-55	1130	W	22	Moderate continuous rain.
Do.	1200	W	22	Do.
Do.	1215	W	40	Moderate intermittent rain.
Do.	1230	W	50	Moderate continuous rain.
Do.	1300	W	55	Do.
Do.	1330	W	38	Do.
Do.	1400	W	40	Do.
Do.	1430	W	25	Do.
Do.	1500	W	25	Do.
Do.	1530	W	35	Do.

TABLE 30—Contd.

Date	Hour of obsn. IST	Wind		Weather remarks
		Direction	Speed (Kts.)	
30-11-55	1600	W	35	Moderate continuous rain.
Do.	1630	W	35	Do.
Do.	1700	W	48	Slight continuous rain.
Do.	1730	W	28	Moderate continuous rain.
Do.	1800	W	50	Do.
Do.	1830	W	38	Slight continuous rain.
Do.	2030	SW	39	Moderate continuous rain.
Do.	2330	SW	25	Slight continuous drizzle.
1-12-55	0230	S	13	Intermittent slight drizzle.

The sudden increase in the wind speed at Jaffna from 22 knots at 1200 hrs. to 40 knots at 1215 hrs. indicates that the storm stage would have been reached between 1200 hrs. and 1215 hrs. IST. The storm continued to move west and became severe by the evening. It was centred at 1730 hrs. IST about 70 miles to the southeast of Nagapattinam which reported northnortheasterly wind 52 knots and continuous moderate rain. During the course of the night, the severe storm came close to Point Calimere, skirted the northern coast line of Palk Bay (which runs nearly west to east) and crossed coast at a place called Rajamadam (Lat. 10°20'N and Long. 79°21'E) in Tanjore district at about 0400 hrs. IST of 1st December. Evidence regarding the existence of a calm centre of the storm was available from the following reports collected by Sri C. R. V. Raman, an officer of the India Meteorological Department.

- (1) Report from Head Light House Keeper, Point Calimere (Lat. 10°17'N and Long. 79°53'E) —

“Heavy rains and northerly gales commenced at 1800 hrs. of 30th November. Winds veered to northeast and strengthened further by 2330 hrs. This was followed immediately by a lull which lasted for half an hour when winds died down and rains stopped. There was dead calm with no noise at all. During the lull stars were seen. People got out thinking that the storm had passed away and began merrily picking fallen coconuts. But they were warned by the fishermen and wiser folk that strong winds from the opposite direction will commence at any time and that all people should immediately seek shelter. Soon after midnight, hurricanes recommenced, this time from a southeasterly direction and heavy rains also started.”

- (2) Report from Station Master, Thambikkottai (Lat. 10°22' and Long. 79°28'E)—

“Northerly gales and heavy rains commenced at about 1930 hrs. on 30th November. The winds gained in strength with fierce gusts and squalls and veered slightly by 0130 hrs. on 1st December. Suddenly the howling winds quietened into a deadly calm. Leaves did not even move or hustle. Rains stopped. Clouds lifted. Moonlight penetrated through thin layers of clouds in the sky. During the lull, the Station Master got out of his office to see whether his staff members on duty were safe. At

0230 hrs. winds strengthened and they were now from southeast/south and heavy rains commenced once again. The Station Master was lashed by the southerly gale and had to run for shelter.”

- (3) Report from Deputy Port Conservator, Adiramapatnam (Lat. 10°21'N and Long. 79°24'E)—

“Heavy rains accompanied by northerly gales commenced at about 2030 hrs. on 30th November. Building up in strength and veering slightly the gales continued till 0230 hrs. on 1st December when a sudden lull passed over the station. Rains stopped and there was no rustling of leaves even. People, especially fishermen, knew that the hurricanes would start again and did not venture out. By 0330 southerly hurricane winds commenced with redoubled vigour followed immediately by torrential rain, which lasted for the next three hours or so.”

- (4) Report from Headman of Sethu Bhava Sattiram (Lat. 10°13'N and Long. 79°17'E) —

“On the 29th night itself the sky was overcast at Sethu Bhava Sattiram and rains commenced. Heavy downpours accompanied by strong northwesterly winds began at 2100 hrs. on 30th November. The velocity of wind further increased after 2300 hrs. and between 2 A.M. and 3 A.M. on the morning of 1st December they backed to west attaining still greater speeds. At 3 A.M., however, a lull set in for half-hour. For a few moments the moon was visible through breaks in the clouds. The leaves stood still on the trees. Fishermen were able to come out of their huts to inspect the damages. Very soon after 3-30 A.M. the storm broke in again with winds now from south/southeast. The southerly gales weakened after 9 A.M.

The ‘eye’ was estimated to have a radius of about 8 miles and in the inner core of hurricane winds the wind speed was estimated to be about 80-100 mph. After crossing the coast, the severe cyclonic storm gradually weakened and by 0830 hrs. of 1st December it became a depression with its centre about 50 miles south of Tiruchirapalli. During the course of the next day, it weakened further and moved away into the southeast Arabian Sea as a low pressure wave.

The approach of the storm towards the coast on the 30th evening coincided with the epoch of high tide and there was a destructive tidal wave which overran a low-lying coastal tract, 15 to 20 miles long to the north of the storm track. Shortly before midnight, waters of the sea appeared to have risen 10-15 ft. a.s.l. and, lashed by the strong winds, were driven inland upto a distance of 2 to 5 miles. This deluge was responsible for the grimmest tragedy associated with this storm. An entire community of workers of the salt pans on the shores of Vedaranyam estimated at about 200 was washed away into the Sea by the receding waves. Evidence is also available to indicate that at several places (Pamban, Devipattinam etc.) to the south of the storm centre, there was a recession of the sea for a distance of about 200 yds. apparently caused by the westerly gales which coincided with the epoch of low tide. Another destructive feature of the storm was the occurrence of prolonged heavy rain after the dissipation of the storm. In many places very heavy rain continued for 36 to 48 hours after the passage of the storm. Several places in Ramanathapuram district had record rainfall ranging from 15" to 25" during a 48-hour period,

The damage caused by the cyclone resulted from three factors—(1) the tidal wave (2) hurricane winds and (3) prolonged heavy rain, resulting in floods. Tanjore district suffered mostly on account of the first two factors, while in Ramanathapuram district which is noted for drought conditions, the bulk of the damage was caused by the heavy continuous rain. This district does not often get heavy rain and even the occasional heavy downpour that it gets does not usually last long.

The storm took, according to press reports, a heavy toll of about 500 human lives and about a lakh of cattle heads, besides inflicting heavy damage to property and seriously dislocating rail, road and telegraphic communications in the southern districts of Tamilnad. By far, the greatest damage occurred in the district of Tanjore and as such, the storm may appropriately be designated as the "Tanjore Cyclone."

The pressure deficiency at the centre of the storm could not be observed as there were no observatories equipped with barometers or barographs at or near the place where it struck the coast. Estimation of the pressure at the centre is also rendered difficult on account of the prevalence of extremely steep pressure gradients in the inner storm area. It is interesting to note in this connection that in the case of the severe Nagapattinam cyclone of November 1952 (*vide* India Weather Review, Annual Summary, Part C), pressure gradient of the order of 1 mb. per mile was actually observed in the inner storm area immediately surrounding the calm centre. Considering the fact that the present storm had many characteristics similar to the 1952 storm, *i.e.* extent, intensity, damage caused by winds, the existence of a calm centre, etc. it is likely that the central pressure defect in the two storms might also be of the same order. It may be recalled here that the central pressure deficiency for the 1952 storm had been estimated to be about 60 mbs, the actual value observed at Nagapattinam being 40 mbs.

The following table gives the district averages and the significant amount of rainfall in association with the storm.

TABLE 31

District	District averages on						Particularly heavy falls
	November			December			
	28	29	30	1	2	3	
Madras	2.2	1.5	1.3	..
Chingleput	2.3	1.7	1.4	..
North Arcot	1.0	1.1	..	..
South Arcot	2.7	2.5	..	1st. Dec.—Chidambaram 5.0"
							2nd Dec.—Kilacheruvol 5.5"
Tanjore	4.5	5.1	1.1	1st. Dec.—Tranquebar 5.4", Nagapattinam 5.4", Tiruvavur 5.2", Tiru- turaipoondi 5.0", Pattukottai 6.6"

TABLE 31—Contd.

District	District averages on						Particularly heavy falls
	November			December			
	28	29	30	1	2	3	
	"	"	"	"	"	"	Arantangi 5'2", Adirampattinam 5'8", Tirupundi 6'8", Muthupet 6'0", Needamangalam 5'0", Pandavavar Head 5'4", Peravurni 7'8", Ichaviduthi 7'2", Talanayar 5'3".
							2nd Dec.—Papanasam 5'5", Valangimam 6'9", Kumbakonam 5'4", Mayuram 7'1", Tiruvavarur 5'7", Tiruturaiipoondi 7'4", Vedaranyam 5'1", Mannargudi 6'9", Pattukottai 6'8", Arantangi 7'0", Adirampattinam 5'0", Kattumavadi 14'7", Muthupet 5'5", Needamangalam 5'7".
Tiruchirapalli.	2'2	3'3	..	..	2nd Dec.—Ariyalur 7'4", Jayankondam 5'3", Vembavoor 5'7", Nandiyar Head 5'5", Ponnerihead 6'0", Upper Anicut 5'6".
Pudukottai Divn.	5'0	5'2	..	..	1st Dec.—Alangudi 7'9", Karambakkudi 5'9", Kilanilai 6'5", Malaiyur 14'0", Perungalur 7'5", Pudukottai 8'0".
							2nd Dec.—Karaiyur 5'2", Kilanilai 8'5", Malaiyur 11'0", Ponnamaravathi 10'2".
Madurai	3'1	..	..	1st Dec.—Melur 5'3".
							2nd Dec.—Madurai 6'5", Tallakulam 6'3", Pulipatti 7'6", Chittampatti 6'9", Thaniyamangalam 9'0".
Ramanathapuram.	1.6	6'1	3'8	..	2nd Dec.—Theethandathanam 15'3", Vattanam 17'3", Tiruvadanai 7'1", Manamadurai 6'3", Morekulam 9'3", Kamuthi 7'7", Pamban 8'6", Ramanathapuram 9'0", Sivaganga 6'7", Tirupattur 10'4", Aruppukottai 5'1", Mukkulathur 5'3".
							3rd Dec.—Theethandathanam 5'6", Vattanam 7'1", Morekulam 5'7", Pamban 6'3", Ramanathapuram 13'4", Mukkulathur 8'5".
Tirunelveli	2'3	..	..	3rd Dec.—Vilathikulam 6'1", Arasadi 7'4", Tuticorin 7'4", Ottapidaram 6'4".

II—ACCOUNT OF WESTERN DISTURBANCES DURING 1955.

The western disturbances during January, February, April and October were active and gave good precipitation over the northern and central parts of the country. Those during the months of March, May, November and December were generally feeble. During the monsoon months June to September, a large number of upper level westerly waves moved across the extreme north of the country and served to strengthen the monsoon there. A list of 51 western disturbances excluding the westerly waves during the monsoon, that affected the country, classified according to the nature of precipitation caused by them is given in the following table. Brief descriptions of two of the more active ones are added.

TABLE 32

Nature of precipitation	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Widespread	3	2	..	1	4	1	..	..	..	1	..	1
Local	..	1	2	4	..	2	1	..	..	3	..	1
Little or none	4	2	4	3	2	2	..	..	..	1	2	4
No. of disturbances each month.	8	6	8	4	8	4	..	..	..	5	2	6

1. Western disturbance of the period 21st to 26th January 1955. -An active western disturbance was noticed over the northern divisions of West Pakistan on the 20th morning with an induced secondary trough over the northeast Arabian Sea and neighbourhood. On the next day, the main western disturbance moved into the Punjab(I) while the secondary lay as an extended trough over the whole of north Arabian Sea. On the 22nd, the eastern end of the trough over the north Arabian Sea became active over the Gulf of Cambay and neighbourhood and pressures commenced falling briskly over region from the Gulf of Cambay to the central parts of the country, where simultaneously, there was an incursion of moist air in association with the intensification of an anti-cyclonic circulation over the north Bay of Bengal. On the 23rd, the main western disturbance moved away across the Punjab-Kumaon hills while a secondary 'low' appeared over Madhya Bharat and neighbourhood. On the same day, a low pressure area apparently induced by a fresh western disturbance moving across Afghanistan appeared over northwest

Arabian Sea and a trough line at 3,000 ft. a.s.l. extended from the northwest Arabian Sea to Gangetic West Bengal. The secondary low over Madhya Bharat with its associated trough moved slowly eastwards and became unimportant by the 26th.

In association with these disturbances there was a good spell of precipitation over the Punjab(I), Uttar Pradesh, Rajasthan and the central parts of the country between the 21st and 24th, the rainfall extending into Bihar and Chota Nagpur during the next two days. Principal amounts of rainfall recorded were—Sutna 3" and Nainital 2" on the 23rd; Umaria and Jabalpur 2" each on the 24th and Bahraich, Dehra Dun and Seoni, 2" each on the 25th. The precipitation over the hills of the Punjab and of west Uttar Pradesh was accompanied by heavy snowfall which continued until the 26th. According to press reports, road transport and telecommunications in Simla, Mussoorie and other hill stations were disrupted due to heavy snowfall.

2. Western disturbance during the period 11th to 16th April 1955. -An active western disturbance appeared over the northern divisions of West Pakistan on the 11th April and on the next day, it moved into Punjab(I). Moving eastnortheastwards, the western disturbance broke up over the Punjab-Kumaon hills on the 13th after inducing a low pressure area over east Uttar Pradesh and adjoining Bihar. This low pressure area moved slowly eastwards and became unimportant on the 16th. In association with this western disturbance and its induced 'low', fairly widespread or local thundershowers were reported from the Punjab(I) and northwest Uttar Pradesh on the 13th and 14th. Snowfalls were reported from the hills of north Punjab(I) on these days. Fairly widespread thundershowers were also reported from Assam on 14th and 15th and from Sub-Himalayan West Bengal on the 14th.

In the rear of the western disturbance, there was an influx of cold air into northwest India and the central parts of the country. Both day and night temperatures fell rapidly over these areas and were 8°—15°F below normal over northwest India, Gujarat, north Deccan (Desh) and the central parts of the country between the 15th and 17th. The maximum temperature at Udaipur on the 14th evening was 51°F which was 20°F below normal.

III—LOCAL STORMS 1955

Of the local storms reported in newspapers the following are noteworthy

Place	Date	Time	Classification of storm	Loss of human life	Remarks
1	2	3	4	5	6
Nagpur	24th Jan.	Night	Severe hailstorm accompanied by rain.	..	The storm caused power failure and uprooted trees. Roofs of several huts were blown off. Hails were of the size of potatoes.
Simla	2nd March	Afternoon	Hailstorm accompanied by gale.	..	
Gauhati	17th March	Night	Thunderstorm	..	Thatched roofs were blown away and many houses were badly damaged by the storm. Electric and telephone services in many parts of the town were completely dislocated.
Bankura	25th March	Afternoon	Gale.	..	The gale caused damage to several huts. Several trees fell down causing damage to roads and telegraph, telephone and electric lines. One boy was seriously wounded by a falling tree.
Imphal	25th March	Night	Severe cyclone	..	Large trees were uprooted and Kutlia house tops blown away by the cyclone. Electric posts and wiring were twisted plunging whole town in complete darkness. Two persons were seriously injured by collapse of a house top.
Narayanpur Tea Estate	25th March	Night	Gale followed by hail	8	A family of eight persons perished when a house was directly hit by lightning. Many houses were damaged and trees were uprooted.
Karimganj Division.	Sub- 31st March	Night	Thunderstorm	2	Two persons lost their lives as a result of house collapse at Kalibari Bazar. Complete damage was caused to standing Duro paddy in about 1000 acres of land due to flooding.
Calcutta	3rd April	Evening	Thundersquall	..	Maximum wind speed attained during the squall was 39 miles per hour.
Dum Dum	8th April	..	Nor'wester	..	The storm prevented aircraft from landing at Dum Dum. Maximum wind speed was 82 miles per hour.
Amritsar	12th April	Early morning	Hurricane	5	Five persons were killed and 9 others were injured as a result of collapse of houses. Many trees were uprooted leading to dislocation of electricity and telephone services. Corrugated iron roofs of houses and shops were blown off.
Ambala	12th April	Morning	Thunderstorm accompanied by hail and squall.	..	Many trees were uprooted and telecommunications were interrupted. Maximum wind speed was 60 miles per hour.
Jalpaiguri	13th April	Evening	Hailstorm	..	Many roof tops in the town and the outskirts were blown away and many trees were uprooted causing injuries to some people. Several cattle were killed. Electric supply and telegraph communications were affected. Loss to property was heavy.
Sadar (Sub-division of Muzaffarpur).	13th April	..	Severe hailstorm	4	Four persons were killed and 27 were injured and a large number of cattle were killed. Rabbi bundles kept in barns for winnowing and grains stocked in barns were blown away. Crops and plantations were seriously damaged. Tiled roofs collapsed due to the weight of hailstones while thatched roofs were blown off. In some villages hailstones weighing 4 to 5 seers were reported.
Calcutta	27th April	Evening	Nor'wester	..	Maximum wind speed was 42 miles per hour. The nor'wester brought down the temperature by 5°F.
Jhargram	27th April	Evening	Storm	..	Nearly 45 families were rendered homeless by the storm. Roofs of many houses were blown away and mud walls of several houses collapsed.
Agartala	27th April	Afternoon	Severe gale	..	The storm razed to ground the college hostel and caused serious damage to many other houses. Telegraph and telephone services were also disrupted. Maximum wind speed was 50 miles per hour.
Several Areas of Asansol Sub-division.	28th April	Evening	Hailstorm	..	The hailstorm blew off thatched roofs and sheds of several houses and brought down some D.V.C. quarters at Durgapur. Many domestic animals were wounded by falling hailstones.
Imphal	29th April	Afternoon	Hailstorm	..	Several tin-sheds and thatched houses were blown off. Many trees were uprooted dislocating electric and telephone wires. Some vegetable and fruit gardens were damaged.
Bhagalpur Dist.	2nd May	Night	Severe gale followed by showers	..	Hundreds of huts were blown off, trees were uprooted and mango crops damaged in the district.

1	2	3	4	5	6
Gwalior	2nd May	Evening	Duststorm accompanied by rain.	..	Power supply and telephone communications were dislocated.
Madras	5th May	..	Thunderstorm and heavy rain.	..	Many parts of Madras were flooded.
Amreli	6th May	..	Strong gale and showers	..	Trees were uprooted and road communications disrupted on account of gale.
Hirenki and Sunderpore (near Delhi)	10th May	Day time	Severe hailstorms	5	Five persons were killed in the hailstorm and several persons and heads of cattle sustained injuries. Standing crop of sugarcane and vegetable were completely destroyed. About 50 per cent of grains and fodder lying unharvested in the fields also damaged. A number of katcha and pucca houses in both the villages collapsed. Hail was of half-a-pound size.
Baidyeswar (Dist. Puri).	15th May	..	Severe storm	2	Two women were killed by a falling tree and roofs of houses were blown off and trees uprooted by storm.
Kodaikanal	17th May	Night	Severe gale and heavy rain.	..	The gale uprooted hundreds of trees, telegraph and electric posts and caused landslides. Roofs of many houses were blown off.
Lanja (Dist. Ratnagiri).	19th May	..	Storm.	..	The storm tore off roofs and caused dislocation of road traffic.
Delhi	20th May	Evening	Duststorm	..	Four persons were injured and roofs of several tenements were blown off during the duststorm. The roof of the Power House in Rajinder Nagar was also blown off. Wind speed reached 47 m.p.h.
Jalpaiguri	22nd May	Night	Storm	1	Several persons were injured, one fatally, when the roof of a house collapsed during the storm. Many trees were uprooted and roofs of several houses were blown off.
Balurghat	23rd May	Evening	Hailstorm	..	A few huts were blown off and a considerable damage was done to the mango crop.
Rampurhat	24th May	Evening	Storm	..	The storm damaged a number of houses and uprooted trees. Telegraphic and telephonic communications were badly damaged.
Bijnor	24th May	Afternoon	Severe hailstorm preceded by dusty gale.	..	The bumper mango crop was badly damaged. Though the storm lasted for 15 minutes, the earth was covered by 2 inches of hailstones. A few hailstones were of one inch in diameter.
Ambala	25th May	Evening	Duststorm	..	The duststorm caused damage to property and telecommunications. Wind speed reached 50 m.p.h.
Jullundur	25th May	Evening	Duststorm followed by rain.	..	A large number of trees were uprooted. Visibility was reduced to a few yards. Wind speed 75 m.p.h. Telecommunications and power supply were affected.
Delhi	25th May	Evening	Severe duststorm	..	Ten persons were injured when roofs of 35 houses were blown off by the duststorm. Wind speed reached 76 m.p.h. and temperature dropped by 25° from 101°. Visibility was reduced to 600 yards.
Ambala	25th May	Evening	Duststorm	..	The storm caused serious damage to property and telecommunications. Maximum wind speed was 50 m.p.h.
Jullundur	25th May	..	Duststorm	..	A large number of trees fell down and the whole system of telecommunications was dislocated. Power supply was also affected. Visibility was reduced to less than 10 ft.
Cuttack	25th May	Evening	Storm	..	The town was plunged into darkness when the overhead wires of the power station snapped during the storm.
Nasik	26th May	Night	Gale	1	Swift gales blew a roof top worker off his feet and dropped him dead some distance away. A number of huts were blown off.
Calcutta	28th May	Afternoon	Thundersquall	..	The thunder squall brought down the temperature by 18° from 99° to 81°F. Maximum wind speed reached at Alipore and Dum Dum were 46 m.p.h. and 45 m.p.h. respectively.
Lalbazar Pargana	31st May	Night	Storm	..	Almost all the huts of cultivators in Lalbazar Pargana were blown away and a number of big trees uprooted by the storm.
Suri	1st June	Afternoon	Tornado	..	Walls of many houses gave way, many big trees were uprooted and corrugated iron sheet roofs of many houses were blown off by the tornado. Wind speed was 60 m.p.h.
Budge Budge	1st June	Evening	Squall	1	One person was killed when a roof of corrugated iron sheets, blown over by the storm, slashed his skull.

1	2	3	4	5	6
Burdwan	1st June	..	Nor'wester	..	Several tin roofs were blown away and trees uprooted resulting in injuries to five persons. Maximum wind speed was 55 m.p.h.
Burdwan	2nd June	..	Squall	..	About 100 persons were injured when trees were uprooted, tin sheds were blown off and mud huts were razed to ground by the squall. Traffic was dislocated and extensive damage was caused to overhead electric, telephone and telegraph wires. Wind speed reached 100 m.p.h.
Muzaffarpur	3rd June	Evening	Thunderstorm	4	Four persons were killed and a dozen were injured when several trees crashed on some huts. Many trees were uprooted and electric and telegraph poles razed to ground. Roof-tops and corrugated tin-sheds were blown away.
Muzaffarpur	3rd June	Evening	Storm	4	A dozen big trees were uprooted. Four persons were killed and 23 injured on account of the storm.
Jharia coal field area	3rd June	Evening	Storm	5	Five persons were killed and 23 were injured.
Mahuli	7th June	Morning	Gale.	..	Due to the gale, an entire passenger train except the engine capsized while standing at Mahuli station on the Nagpur Nashbiri narrow gauge line. Communications were cut off owing to uprooting of telegraph poles.
Ahmedabad	10th June	Evening	Severe duststorm followed by rain.	1	Hundreds of trees and several telegraph, telephone and electric posts were uprooted. Corrugated iron roofs of many houses were blown off on account of the storm. Maximum wind speed was 68 m.p.h. One woman died as a result of injuries resulting from the fall of a corrugated iron sheet.
Burnpur	10th June	..	Storm	..	Some huts were blown off and large trees were uprooted by the storm.
Bindwara (Dist. Monghyr).	19th June	..	Storm	..	About 200 tiled roofs were blown off and several thousand maunds of wheat were blown away by the wind. Several bullock carts were lifted up and thrown several furlongs away. Several people were injured.
Ferozepur	27th June	Evening	Gale followed by rain.	..	Telephone lines were dislocated, tin roofs blown off and trees uprooted by the gale. Power supply also failed.
Amritsar	27th June	Night	Thunderstorm	..	A large number of trees were uprooted and telegraphic communication and electricity supply were dislocated.
Puri	15th August	..	Thunderstorm	4	Four persons and several heads of cattle were killed by lightning in the suburbs of Puri.

IV—WINDS OF FORCE NINE OR MORE IN THE INDIAN SEAS

Excluding dates of storms and depressions, a description of which has been given above, winds of force 9 or

Name of ship	Date	Approximate position	
		Lat. °N	Long. °E
Steel Age	15-6-55	12.7	56.4
Vengeance	17-7-55	13.1	56.1

more were recorded on ships in the Indian Sea during the year 1955 on the following occasions—

Name of ship	Date	Approximate position	
		Lat. °N	Long. °E
Vengeance	18-7-55	13.0	53.1
Matheran	9-8-55	13.0	55.0

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(Complete list, up to January 1958, including those Publications which are now out of print.)

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Instructions to observers at the Surface observatories, Part I (1954) Rs. 3-10-0
 Cloud Atlas, edition 3 (1945). Rs. 2-2 or 3s. 6d.*
 Tables for the Reduction of Meteorological Observations in India, Reprint of 3rd edition (1947).* Rs. 5-12.
 Relative Humidity Tables (1937). As. 7 or 9d.*
 Hygrometric Tables (1000 mb.) edition 2 (1949). As. 14 or 1s. 3d.
 Hygrometric Tables (900 mb.) edition 2 (1955). Rs. 1-14 or 2s. 9d.
 Hygrometric Tables (800 mb.) edition 2 (1949). Rs. 2-12 or 4s. 6d.
 Hygrometric Tables (700 mb.) 1944.
 Hygrometric Tables, Vapour Pressure. Rs. 3-8 or 5s. 6d.
 Saturation Temperature Tables (1942). As. 10.
 Rainfall Registration (1956).
 Service Instructions for Part-time Observers (1952).
 Instructions for making entries in Pocket Register and Monthly Meteorological Register.
 Weather Code (1955).
 Brief Weather Code (1949). Rs. 1-6 or 2s.
 Aviation Weather Codes (1955).
 Codes for reporting upper Winds and Cloud Directions (1955).
 Code for Upper Air Reports (1955).
 Ships' Weather Code (1949). Rs. 1-10 or 2s. 6d.
 Reports on the Meteorology of India for the years 1875—1890 (16 volumes). Each Rs. 10.†
 Meteorology of the Bombay Presidency (1878).
 Weather and the Indian Farmer (1946).
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 Part II 'Climatology of Air Routes (1936).* Rs. 2-2 or 4s. 10d.
 India's Climates—Summary for Airmen (1943). Re. 1 or 1s. 6d.
 Meteorological Organisation for Airmen, M.O.A. pamphlet (1949).
 Meteorological Conditions affecting aviation over the Northwest Frontier (1934). Rs. 1-8 or 2s. 6d.

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III. ATLASES AND CHARTS.—

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 Meteorological Atlas of the Indian seas and the North Indian Ocean (1908).* Rs. 13.
 Monthly Weather Charts of the Bay of Bengal and adjacent sea north of the equator, showing mean pressure, winds and currents (1886).* Rs. 5.
 Monthly Weather Charts of the Arabian Sea and the adjacent portion of the North Indian Ocean showing mean pressure, winds and currents (1888). Rs. 5.
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 Daily Weather Reports and Charts of the Indian Monsoon Area for the Years 1893 to 1899, each month. Re. 1*.
 Normal Weather and Pilot Charts of the Indian Monsoon Area for 8 a.m. for each month November 1900 to August 1908, each month. As. 4.*
 Storm Tracks in the Bay of Bengal (1925). Rs. 3-6 or 5s. 9d.*
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 Climatic Charts of India and Neighbourhood for Meteorologists and Airmen (1943).*
 Climatological Atlas for Airmen (1943). Rs. 5-2 or 8s.
 Climatological Charts of the Indian Monsoon Area (1945). Rs. 16 or 25s.

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- Report of the Vizagapatam and Backergunge Cyclones of October 1876 (1877). Rs. 3.*
- Report on the Madras Cyclone of May, 1877 (1879). Rs. 3.*
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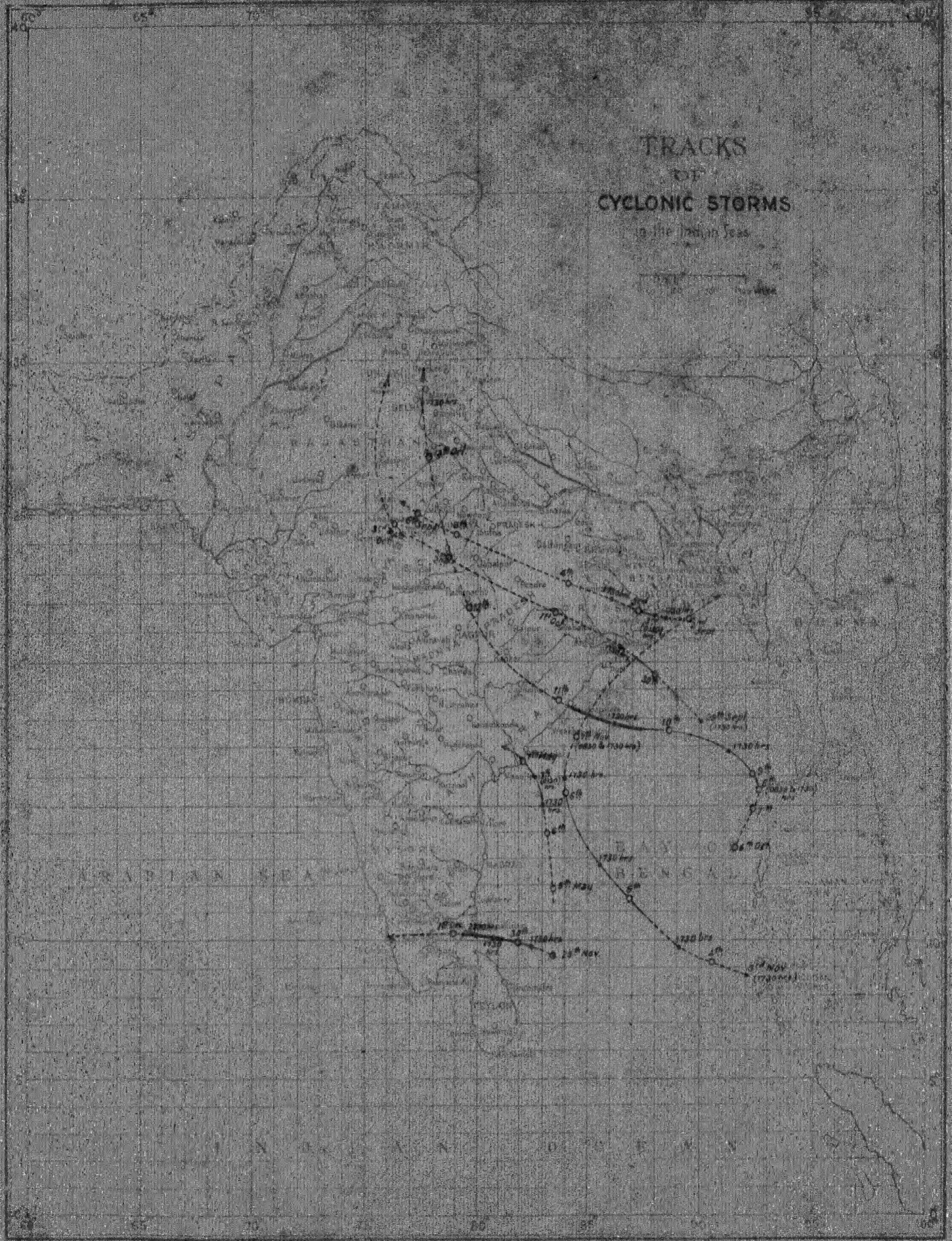
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Scale
0 50 100 Miles



CIRCLE INDICATES POSITION OF CYCLONE OR DEPRESSION AT 0630 HRS.

Scale
0 50 100 Miles

Depression

Storm

Severe Storm

